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A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE.

"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

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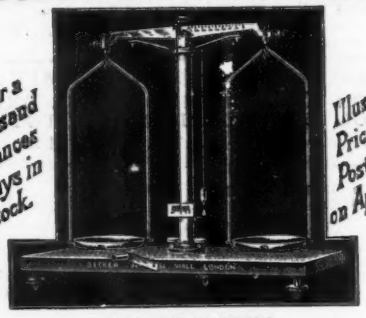

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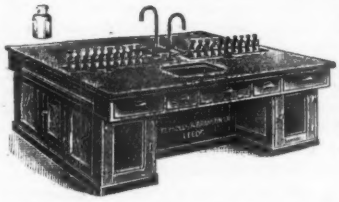

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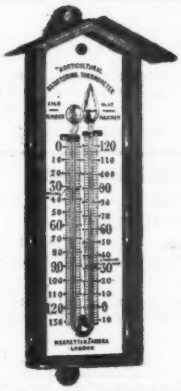

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December 10, 1918.

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PERCIVAL SHARP,
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UNIVERSITY OF BRISTOL. DEMOBILISATION.

SPECIAL REGULATIONS have been made to allow intending students who have served in the war or in the scientific service of the war to be admitted to matriculation by vote of Senate on their educational qualifications, without formal examination; and also to allow of such students entering the University in January if candidates in Arts; in January, or between January and May, if candidates in Science, Medicine, Dental Surgery, or Engineering; and if grounds be shown, counting their first year's attendance as though it had commenced in October. Engineering students in special cases may be allowed to count one whole year's attendance.

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The Council invite applications for the post of LECTURER in AGRICULTURE. Full particulars can be obtained on application to the REGISTRAR.

THURSDAY, DECEMBER 12, 1918.

LICHENS: THEIR DESCRIPTION AND CLASSIFICATION.

A Monograph of the British Lichens. A Descriptive Catalogue of the Species in the Department of Botany, British Museum. By Annie Lorrain Smith. Part i. Second edition. Pp. xxiv+520+71 plates. (London: Printed by Order of the Trustees of the British Museum, 1918.) Price 30*s*.

THE need for a comprehensive descriptive work on British lichens has been increasingly evident during the last decade. This necessity was accentuated rather than satisfied when Miss Annie Lorrain Smith in 1911 supplied a second part to the "Monograph of British Lichens," the first part of which had been written by the Rev. James Crombie in 1894. During the intervening years so many advances had been made in our knowledge of lichens, and in the method of presenting such knowledge, that a revision of the first part of the monograph was absolutely essential. Crombie attached too little importance to the reproductive characters of the lichen, and consequently his system of classification was too artificial for present-day botanists. There had also been some reaction against the descriptive methods of his day, when lichenologists seemed to vie with each other in coining terms to express some infrequent phase of a lichen-organism.

In the second edition of part i. of the monograph an admirable attempt has been made to bring the work up to the standard of handbooks on other botanical groups, to classify the lichens in accordance with more modern views, to incorporate the discoveries of recent years, and to simplify the descriptions of the species. Another important improvement is the method of illustration. The sketchy figures given in the text of the first edition are replaced by seventy-one plates of drawings expressly prepared by Mr. P. Highley with his usual regard for both accuracy and beauty.

The introduction gives a short and simple account of the lichen-plant. Its chief fault lies in its brevity. The treatment is so excellent that an Oliver Twist attitude is engendered, and one wishes that a longer account had been given of such matters as the relationship between the algal and fungal constituents. This relationship is considered as symbiotic. Wallroth's and Elfving's views as to the parasitic nature of the fungus are not even considered worthy of mention. The symbiotic nature of the lichen-organism is generally accepted by lichenologists, and the fact that one symbiont (the fungus) occasionally preys on the other (the alga) is analogous to what has been shown by Keeble to occur in Convoluta.

The system of classification adopted is a wonderful advance on any system hitherto given in British works. Both symbionts are considered, the incomplete knowledge of phlogeny is requisitioned, and less attention is paid to the vegetative characters of the thallus.

The arrangement of the spores on basidia or in asci give the two sub-classes Basidiomycetes and Ascomycetes. Since all British lichens belong to the latter sub-class, it is the only one considered, and is divided into two series, Gymnocarpeæ with open apothecia, and Pyrenocarpeæ with perithecia. The Gymnocarpeæ are subdivided into three sub-series: (1) Coniocarpineæ with powdery apothecia or perithecia; (2) Cyclocarpineæ, having apothecia with open discs and fungal ancestors belonging to the Discomycetes; and (3) Graphidineæ, having apothecia with narrow discs, their fungal ancestors being allied to the Hysteriaceæ. The sub-series Cyclocarpineæ, with which part i. is mainly concerned, is next split up into orders according to the algal symbiont, the presence or absence of a thalline margin to the apothecium, and the form of the thallus, the relative importance assigned to these characters being generally in this sequence.

It is unfortunate that the name of order is retained for groups which, in accordance with modern views, ought rather to be called families. The retention of order cannot be altogether justified by the fact that this name was used for similar groups in part ii.

Some of the families have somewhat incongruous components if the views of sporologists have sufficient importance attached to them. Physciaceæ (unintentionally given as Physiaceæ on p. 189) includes Xanthoria and Placodium with colourless polarilocular spores, as well as Physcia with dark spores which are more 1-septate than polarilocular. Xanthoria and its allies would have been better placed as a separate family. Lecanoraceæ includes Lecanora, having eight simple spores in the ascus, Acarospora with many simple spores in the ascus, and Lecania and other genera with septate spores.

Owing to the different system of classification a long appendix is necessary to bring the work into conformity with part ii. In this appendix the species of Cladoniaceæ and Gyrophoraceæ are described, the members of the Sarcogyne section of Lecanora are rightly placed as Biatorellas, whilst Dirina, Roccellæ, Pyrenidium, and a number of species new to the British Isles are described under their proper families.

There is a considerable amount of alteration of names, mostly well-warranted according to the rules of priority. It is unfortunate that some well-established names suffer, and one could wish that the author had followed a similar course as that adopted for *Lecanora campestris*, the generally accepted specific name being retained, whilst the doubtful, though prior, name of *punctatus* was rejected. Other authors have considered themselves justified in rejecting some of the combinations used by Miss Smith, on account of their inappropriate or doubtful nature. *Synechoblastus rupestris* displaces *Collema flaccidum*, though many authors have considered the specific name of *rupestre* as of too doubtful priority to take the

place of the well-established *flaccidum*. In *Leptogium microphyllum* the well-known specific name is altered to *fragrans*, a name which has been rejected by many authors on account of its inappropriateness, *Lichen fragrans* being merely an accidental fragrant state. It is difficult to understand why *aeruginosa* (Chænotheca, p. 8) displaces *stemonea*, since in the accompanying list of synonyms the first date assigned to *aeruginosum* is 1813, whilst that for *stemoneum* is 1810. Naturally there are many alterations in the status of a plant according to the personal views of the author.

For the distribution and frequency of the species too close a dependence is placed on the specimens in the Museum, and too little regard is paid to independent investigations. Cumberland is given as "the only British locality" (a phrase of too common occurrence) for the frequent *Pertusaria wulfenii* var. *rugosa*. *Lecanora pallida* (*albella*) cannot be considered "rather rare," and *Placynthium nigrum* form *triseptatum* is not "rare." *Schizoma lichinodeum* occurs not only on Ben Lawers, "the only locality," but also on the neighbouring Killin hills; and *Synalissa intricata* is found in more than one locality.

The iodine reactions for the Collemas are not always rightly stated; both *C. pulposum* and *C. multifidum* give a negative reaction, and not a reddish one.

The figure on p. xv represents a biatoroid rather than a biatorine apothecium. The spores of *Acarospora squamulosa* on plate 52 are given as almost spherical and approximately 7×6 μ, whereas the text (p. 333) rightly gives them as $8–12 \times 4–5$ μ.

Considering the magnitude of the work, such discrepancies are few, and the author can have the satisfaction of knowing that it is the most useful work on British lichenology which has hitherto been published. W. W.

IMPERIAL TELEGRAPH FACILITIES AND THEIR ADMINISTRATION.

Telegraphy, Aeronautics, and War. By Charles Bright. Pp. xvii+407. (London: Constable and Co., Ltd., 1918.) Price 16*s*. net.

THIS volume comprises seventeen addresses and articles on inter-Imperial communication given before the London Chamber of Commerce, the Royal Society of Arts, etc., and contributed to the *Quarterly Review*, *Nineteenth Century*, *Empire Review*, etc.; seven memoranda upon aeronautics by the author, presented to Government Departments; and two popular lectures on the war. These three subjects are correlated, and their treatment, as it were, is brought up to date, in an introduction of seventy-four pages, which constitutes a valuable adjunct to the collection.

The chapters are all of substantial and practical interest—the forcible expression of the views of a man who thinks with a view to action. Taken together, the predominating impression that they give is that Mr. Bright is no pacifist as regards either the war or any subject of which he treats. He is so combative that, in reading, one almost feels constrained to lift one's arm to ward off a blow! You want him to be on your side! Then all is well and forcibly put, and there is a great mass of interesting and valuable matter clearly expressed.

Mr. Bright has devoted a large part of his life to the subject of cable communication, and his chapters on that subject cover the whole range—apart from technical matters, which he has sought to exclude. The paper reprinted from the *Navy League Annual*, 1911–12, on "The Importance of Inter-Imperial Telegraphy," is a strong plea that in such matters our Government should think imperially. In similar strain he draws a moral from the Atlantic cable system, urging that the allowance of the handing over of the control of British-made and British-owned cables, even to the United States, was unpardonable on any terms. Mr. Bright's long and strenuous advocacy of "All-British" cable routes for strategic reasons has certainly been amply justified during the Great War.

While one could not agree without demur to the whole of Mr. Bright's presentment of the scheme for "Administration of Imperial Telegraphs" (as, for example, where he fails to realise that the difference in profit from the working of the telephone system by the late National Telephone Co. and by the Post Office is due almost entirely to the substantially improved scales of pay awarded to the operating staff), it must be admitted that he shows a masterly grip of the general situation, and his concluding words about ourselves and the Colonies—"surely it is desirable that we should think together, act together, and, if necessary, fight together, in a common cause"—seem now to have more substantial reality than they could have had in April, 1914, when they were spoken.

It is a little surprising to find so independent a thinker tending to accept the popular view of the Civil Service. The Service is a *profession*, and you can no more make it "commercial" than you can make the Bar "religious," or the City "scientific." Those who know best realise that the new Government Departments—administered and controlled by "business" men, and infused with "business" ideals—present all the worst characteristics of the Civil Service, and few of its merits. The only distinctive merit of the new departments is that ignorance has permitted them to "kick over the traces"; but the enlightenment of only three or four years has gone a long way to neutralise that merit. If they are to extricate themselves from their entanglements, it will be years before they can be demobilised.

The Civil Service, which contains a fairly satisfactory proportion of men who possess real business ability (capable of "running" something much bigger than a 'bus!), must be diagnosed on quite different lines if its ills are ever to be effectively treated. Mr. Bright, however, evidently does to a very appreciable extent understand that the

bigger a business becomes, the nearer its system of business and its relation to its staff approximate to Civil Service conditions—boards of directors do not differ essentially from Government Ministries, Boards, Offices, or whatever their title may be, except in the extent and bulk of the business controlled.

The book is certainly full of thought and of detailed information, and is good reading, inasmuch as it helps us to understand what important things we have left undone that we ought to have done. It is not too late to do them now.

A. J. S.

THE ART OF TRAVEL.

Handbook of Travel. Prepared by the Harvard Travellers' Club. Pp. 544. (Cambridge, Mass.: Harvard University Press, 1917.) Price 2.50 dollars.

THIS volume has been prepared by various members of the Harvard Travellers' Club in the hope of promoting intelligent travel and observation. Mr. G. M. Allen is the editor, while Prof. W. M. Davis seems to have been mainly responsible for the choice of authors. Books of this nature written by experts are not numerous, and though they appeal more to strenuous tourists than to serious travellers, they nevertheless have their uses, particularly in more technical matters. Observation is an attribute of most boys, but in later life it is hard to teach. American schooling probably does more than our own to develop it, but the Boy Scout movement, in its best phases, is its great nursery. The next generation of travellers may well prove more observant and not less resourceful than the last.

The first chapter, by Mr. W. B. Cabot, on "Camp and Travel in the North Country," is a fascinating account of woodlore and scoutcraft on the edge of civilisation, despite the author's irritating and ungraceful style. Chapters on tropical and arctic travel are useful and trustworthy guides. In the latter the pyramid-shaped tent, 6 ft. high, should be mentioned. The cover is supported by four bamboos meeting at the summit in aluminium sockets. The opening is a funnel, in the middle of one side, lashed after exit or entrance to exclude drift. The tent has the advantages of being light and of resisting any wind. During a blizzard it snows up and so is protected from both wind and snow. There are useful chapters on medicine and surgery and on determining positions. Dr. Hamilton Rice adds some notes on traverse surveys in South America. Among the other papers may be mentioned a very clear and instructive one on meteorology by Prof. R. DeC. Ward, and some condensed notes on geographical and geological observation by Prof. W. M. Davis. Prof. Davis describes the necessary mental equipment of a traveller as a moderate fund of geographical knowledge, an appropriate terminology, and a desire to do good work. This he thinks is sufficient for an empirical record of plainly visible facts. He does well to insist that care should be taken not to give a wrong impression by the use of inappropriate adjectives and of unnecessary superlatives. Florid language mars many records of travel.

The notes on natural history deal mainly with vertebrates and insects. More attention might well be paid to other invertebrates, since their collection is often neglected. It would be well to emphasise that fish are best preserved by fixing in formalin, and subsequent changes in graded strengths of spirit. A chapter on map-reading might be added. Elementary as such instruction may seem, it would prove useful, for few people, even if in the habit of consulting maps, are able to make full use of them. Cartography is not self-obvious, and, like other forms of notation, must be learnt. Some notes on scales and projections should certainly find a place in the book.

The volume has a compact, handy form which certainly enhances its usefulness. Most chapters have short bibliographies, some of which might with advantage be extended.

R. N. R. B.

OUR BOOKSHELF.

War Nursing. What Every Women Should Know. Red Cross Lectures. By Prof. C. Richet. Translated by Helen de Vere Beauclerk. Pp. xi+119. (London: William Heinemann, 1918.) Price 3*s.* 6*d.* net.

IT may be desirable that the nurse should have the scientific grounding outlined in this book, but to term it "War Nursing" is entirely a misnomer, for of the subject of nursing proper the book contains little.

Commencing with an introduction on the line of conduct of the nurse, the first chapter deals with antisepsis. The microbial basis of sepsis is discussed, and brief remarks are offered on the ideal antiseptic and on the antiseptic substances commonly in use. Anæsthesia is then considered from the physiological point of view, but no hints are given on the practical administration of anæsthetics. It is difficult to understand why this subject is included; either the nurse will not administer anæsthetics when it is unnecessary, or, if she does, practical details should have been given. The third chapter deals with foods—questions of calories and nutritive values—but, again, no details are given for feeding the sick.

Hæmorrhage is next considered, likewise with a similar lack of any practical instruction how to deal with an emergency hæmorrhage. In the two concluding chapters the subjects of fever and asphyxia are dealt with mainly from the physiological point of view, but why the last named should be included in a popular manual is difficult to understand.

A table of quantities—the carbohydrate and nitrogenous contents of foodstuffs and strengths of antiseptic solutions—occupies the last page. Here mistakes occur, *e.g.* solutions of carbolic acid 3 per 1000, and of boric acid 7½ per 1000, are far too weak for practical use.

The book is really an introduction to medical physiology, and might be of service to one who desires to become a professional nurse, but is quite unsuited to the requirements of the "V.A.D." or emergency nurse. R. T. H.

The Student's Handbook of the University and Colleges of Cambridge. Seventeenth edition. Pp. vii+717. (Cambridge: At the University Press, 1918.) Price 6*s.* net.

THERE are three important additions to the present issue of this very useful handbook. First, the regulations for the new diploma in Oriental languages; secondly, the new regulations for the Classical Tripos and the Oriental Languages Tripos; and thirdly, the regulations for the newly established Nita King research scholarship to encourage research in the etiology, pathology, and prevention of fevers.

An account is also given of the new Parliamentary franchise for the University established by the Act of this year. The war has, of course, occasioned temporary emergency legislation on the part of the University authorities, and the various enactments are duly summarised.

Parents and intending students will find here all the information they seek concerning the University and the different colleges.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Late Mr. R. P. Gregory.

IN supplement to Prof. Seward's sympathetic notice of the late Mr. R. P. Gregory in NATURE of November 28, I venture to add a few words as to the peculiar interest of his genetic work. Mr. Gregory was at first associated with me in the proof that the familiar heterostylism of Primulas is an allelomorphic phenomenon. He next undertook a laborious inquiry into the sex-polymorphism of *Valeriana dioica*, but, in spite of much experiment, the case proved intractable, and little positive result was reached. About this time he declined a lucrative post which would have, as he feared, meant the practical abandonment of research, and, undeterred by a rather disappointing experience, he attacked several problems met with in the genetics of *Primula sinensis*, to which he devoted his spare energies for many years. Mr. Gregory there encountered a group of facts of surprising novelty and importance, which were described in outline in Proc. Roy. Soc., 1914, vol. lxxxvii.B, p. 484. Certain plants known in horticulture as "giants" have all their organs of very large size, and two races of these are, as he proved cytologically, tetraploid, containing four times (forty-eight) the haploid number (twelve) of normal plants. Breeding from such plants, he found that they are actually endowed with four sets of Mendelian factors instead of the usual two sets proper to biparental inheritance. Various paradoxical consequences were, therefore, theoretically possible, and several of these, as he demonstrated, do occur.

Such tetraploid plants are known to have arisen *de novo* on two separate occasions (once in his own work and once at Messrs. Sutton's, to whom he was indebted for many facilities) from diploid parents, but, as Mr. Gregory discovered, they were incapable of breeding with the races from which they were derived—a fact hitherto unparalleled and indubitably of great significance. When war broke out he became involved in military duties, eventually going out to France and being rather badly gassed. For technical reasons the study of the "giants" had to be suspended, but he kept always in touch with the Primula work, which we maintained for him so far as possible. The purpose of the later experiments was to test the theory that the numerous linkages are indications of successive somatic segregations, a view to which he strongly inclined in preference to current interpretations based on cytological appearances, and he believed that support for the somatic theory was already in some measure provided by his own observations. He left a mass of records bearing on this question, which we hope eventually to publish, but the character and soundness of his work even in its imperfect state give it classical value. W. BATESON.

The John Innes Horticultural Institution,
Merton, S.W.19.

Cyclonic Circulation.

IN consideration of the theoretical or "gradient" wind associated with any system of isobars where the curvature of the path is taken into account, a point of some interest appears to have been generally overlooked in the past. In the steady state the equation connecting V, the velocity of the gradient wind, with γ, the pressure gradient, is $\gamma/D = 2\omega V \sin\phi \pm V^2 \cot\rho/R$, where D=density of the air, ω=angular velocity of the earth, ϕ=latitude, R=radius of the earth, and ρ=angular radius of the small circle which forms the path of the air at the time.

The positive or negative sign is to be taken according as the path is concave or convex to the low-pressure area. For any given pressure gradient and curvature of path there will be two roots for V from this equation—that is, two different velocities, real or imaginary, will satisfy the dynamical conditions. The interesting case where the roots are imaginary has been dealt with by Gold in his discussion of this question some years ago (Meteorological Office, Official Publication No. 190, 1908). In the ordinary cyclones and anticyclones with which we are familiar V has the value given by the smaller numerically of the two real roots, and the conditions pertaining to the larger root seem to have escaped attention.

To take a numerical example, let $\rho = 3°$ and $\phi = 55°$; then, adopting the normal value for the density D, the equation becomes $\pm V^2 + 40{\cdot}7.V - 275\gamma = 0$ after conversion to the units m./sec. for velocity and mb. per 100 km. for pressure gradient. To deal first with the case of curvature convex to the "low," where the negative sign must be taken; putting $\gamma = 1$ mb. per 100 km., the two roots for V become 9 and 31 m./sec. Both roots have the same sign, and correspond with clockwise rotation in the northern hemisphere. In this case (anticyclonic motion) the larger of the two roots does not seem to represent a stable state, and any perturbation would lead to a modification of the whole pressure distribution. This value is not, therefore, of practical interest. The lower value, 9 m./sec., is that which is met with in practice.

In the case of a path concave to the "low," the two roots for V are of opposite sign. The values corresponding with the above pressure gradient are V=6 and −46—that is, V=6 m./sec. for normal counter-clockwise rotation, and V=46 m./sec. for rotation in the opposite direction, *i.e.* clockwise in the

northern hemisphere. The second, as well as the first, of these roots appears to represent stable conditions, and thus a depression revolving with high speed in a clockwise direction in the northern hemisphere is dynamically possible. In practice evidently such a condition could not get started on a large scale, as the rotation of the earth would inevitably cause the turning movement to commence in the normal direction. On a small scale, however, eddies round corners of houses or precipitous headlands might evidently be set up with revolution in either direction. It appears from the above that such rotation once started may, under favourable conditions, persist and develop into a dust whirl or tornado, with revolution either clockwise or counter-clockwise according to the direction of the initial impulse. One cannot impress too strongly on all observers of such phenomena the importance of noting in which direction the rotation is taking place. J. S. DINES.

66 Sydney Street, S.W.3, December 5.

Fuel Economisers.

WITH regard to the fuel economiser designed by Prof. C. V. Boys, and described in NATURE of November 28 (p. 249), I may mention that I have lately been making experiments in the same direction. In the arrangement tested by me the economiser consisted of a large rectangular metal box fixed over the upper part of the grate. The products from the fire were led by a horizontal flue above the fire into the lower part of the box, in which they ascended and heated it, after which they were drawn back to the chimney by a flue over the one by which they entered. The result was a considerable increase in the efficiency of the fire, but on removing the box to make some check readings under ordinary conditions it was found that the arrangement was impracticable. The flues were so coated with soot that it was evident that the box would require to be too frequently taken out for cleaning to make it worth adopting; and I fear Prof. Boys's arrangement will be liable to the same disadvantage. I should, however, mention that the coal used by me was not good, and was very smoky.

With regard to the objectionable appearance of these economisers, I may state that their appearance can be improved by painting them with suitable colours, as it is not necessary to use black. All paints—with the exception of aluminium—with which I am acquainted radiate equally well for heat of wave-lengths given out at the temperatures employed. White, or any colour, is as good as black for the purpose. The same remarks apply to colours with which hot-water radiators may be painted. The colour which harmonises best with their surroundings may be used without reducing their efficiency.

A great deal of the heat lost in the ordinary loosely fitted-in fire-grate might be saved if the fitting in was modified in the following way:—The bottom of the chimney is closed by a large sheet of metal, so as to make the fireplace-opening into a closed chamber; the grate is drawn forward two or three inches to allow of free circulation of air into and out of this chamber at the back of the grate, while the fire is provided with a chimney passing through the sheet of metal forming the roof of the chamber. By this arrangement the air heated by the hot back of the grate, which now goes up the chimney, would be sent into the room. In new grates it might be advisable to increase the amount of heat communicated to the grate by the fire, and also to increase the back surface of the grate by projections, flanges, etc. Great as the heat losses are in room-fires, it is admitted by all that it is our kitchen-ranges which are the great coal consumers and where improvement is most urgently called for. JOHN AITKEN.

Ardenlea, Falkirk, November 30.

THE trouble of cleaning referred to by Dr. Aitken has not in practice been found more than a minor inconvenience, and provision to make this easy is incorporated in the design. I agree with Dr. Aitken that, considering the radiating power alone, there is nothing in the colour, but it is desirable to employ an "enamel" stoved on so as not to smell if the temperature is raised, and I do not know that this can be done equally well with colour. While saving of fuel is most important and urgent at the present time, equable distribution of heat about a room has also its advantages, and it remains to be seen if this result brought about by my device will not itself more than compensate hereafter for the presence of the unobtrusive, if somewhat plain, heat interchangers—or "heavenly twins" as they were called by the first to benefit by their presence. C. V. BOYS.

A Mistaken Butterfly.

IN NATURE of September 5 last an Australian correspondent notes the attraction of the blue knob of a hatpin for a butterfly. When playing golf in Gulmarg (Kashmir) this summer I was frequently put off by a large butterfly settling on the ball just as I was making a stroke. I make a point of keeping my ball white and clean, and the butterflies evidently mistook it for a white flower. S. ROBSON.

Prince of Wales College, Jammu,
October 27.

CHEMICAL CORRELATION IN THE GROWTH OF PLANTS.

WHEN the apical shoot of a fir tree is broken off or injured, it is a familiar fact that one of the lateral branches below changes its direction of growth in order to take the place of the original apical shoot. The change of direction is accompanied by greater vigour of growth. These phenomena attracted the attention of Errera,[1] who suggested, as the reason why the lateral shoots do not tend to grow vertically while the apical shoot is intact, the possibility that the latter might produce inhibitory substances of a chemical nature which travel downwards to the other parts of the tree. Direct evidence was not then available, but the hypothesis has since received confirmation from certain experiments by Dr. Jacques Loeb, who appears to have been unaware of Errera's suggestion.

Although the phenomena are of general occurrence, Dr. Loeb found the tropical plant, *Bryophyllum calycinum*, an appropriate one for the purpose of investigation. The stem carries a series of buds, each in the axil of a leaf, while the leaves themselves are also provided with buds in notches around their edges. Under ordinary conditions all these buds are dormant. But they can be made to grow by various procedures. The common experiment of taking a willow shoot, cutting off the leaves and suspending it horizontally in moist

[1] Brit. Ass. Reports, 1904, p. 814. "Conflits de préséance et excitations inhibitoires chez les végétaux," Bull. soc. roy. botan. belgique, vol. xlii., 1904; reprinted in "Œuvres Physiol. Gén.," p. 101. (Bruxelles, 1910.)

air, can be repeated with this plant. It is found that the apical buds begin to grow first, while none of the others do so. The result, as pointed out,[2] may be explained in two ways: either a bud, when it begins to grow, sends out inhibitory substances towards the base of the stem, or the young growing bud absorbs the whole of some material requisite for growth. This latter explanation appears to hold in the case of the leaf buds, as will be seen later; but the following experiment shows that the former is the correct one for the stem: A piece of stem is laid horizontally. All the leaves are removed, with the exception of the two at the apical node, the petioles of which are left. So long as these petioles remain, the buds in their axils do not grow, but those in the next node below will commence to grow, and when the petioles have wilted and fallen off, the apical buds also begin to grow. Now, if the inhibiting effect of the apical buds on the more basal ones is due to the circumstance that those which grow out first take all the available supply of some necessary material, the buds in the node behind the apical one, since they grew out first, should continue to outstrip in growth those of the apical node which started later. If, on the other hand, the effect is due to an inhibitory substance sent towards the base by the growing bud, the most apical bud should soon outstrip those behind, because the apical buds send out inhibitory substances towards the next lower buds, while they themselves receive none. The actual result is in favour of the latter view. As soon as the petioles have dropped off, their axillary buds begin to grow, and not only rapidly outstrip in size those below, but even retard or stop their growth altogether.

If the effect is due to an actual chemical substance, the inhibitory effect should be in proportion to the size of the growing bud. It is scarcely possible to test this with the apical bud itself, but it can be done with the grown leaf, which also sends out similar material. This is carried by the sap which flows in the same half of the stem as that to which the leaf belongs. A stem is again laid horizontally, and all the leaves are removed except the two of the apical node. No shoots are produced so long as the leaves remain. If one leaf is removed, its axillary bud grows. The following experiment is then made: Twelve stems are taken, and all the leaves except one of the apical ones on each stem are removed, together with the free axillary bud opposite the leaf which remains. Six stems are placed with the leaf upwards, six with the leaf downwards. In the former case no shoots develop, except sometimes that in the second node behind the leaf, on the *lower side* only. In the latter case shoots develop either in the two lateral buds of the node behind the leaf or on the upper side of the second node behind the leaf. The interpretation is that the inhibiting substances, while flowing on the side of the stem where the leaf is, have also a tendency to flow downwards by gravity. If the stem behind the leaf contains only one node, no shoot grows, even when the leaf is below the node. A large leaf sends out a large enough mass of inhibitory substance to flood the buds. But if the leaf is reduced to one-tenth its size, then shoots are formed in the node behind the leaf. That the inhibitory effect of the leaf is not due to its withdrawing nutritive material from the stem is shown by the fact that the petiole left attached to a leaf remains fresh, but wilts if left attached to the stem without the leaf. The nutritive material is therefore sent by the leaf to the stem, not *vice versa*.

The fact that it is the apical bud that begins to grow first is given the following tentative explanation. When the leaves are first removed, the inhibitory substances are present everywhere, but continue to flow towards the base. Hence the most apical node is the first one to become freed from their presence, and when its buds grow they form anew the inhibiting substance which prevents the growth of the more basal buds.

No reference has yet been made to the collateral phenomena of the growth of roots. Observations were made on this point also, and indicated that the leaf sends out material which *favours* the growth of roots. This hormone may be the same as that which inhibits the growth of leaf buds.

In the earlier papers a number of experiments were described which indicate that the growth of the buds in the notches of the leaf is dependent on the amount of some material supplied by the leaf, since the growth is proportional to the mass of the leaf to which the bud is attached.[3] The part played by the direction of the currents in the leaf is also pointed out. The most recent statement of the author's results [4] is that the production of new shoots by a piece of stem is in direct proportion to the mass of a leaf left attached, and hence to the mass of growth material sent out by the leaf. The apex of an intact plant sends inhibiting substances, preventing the buds below from growing.

A theory of geotropic curvature is put forward,[5] in which the growth of the lower side of a stem placed horizontally is explained by the accumulation there of growth-promoting substances. The author[6] appears to hold that the assumption of a "stimulus" due to gravity is unnecessary. But there is experimental evidence that the perception of gravity is a separate phenomenon from the production of the curvature, so that the purely chemical effect by mass action would not be able to explain all the facts.

It should be noted that the production of inhibiting substances is a conception arrived at in the later stages of Dr. Loeb's work, so that some of the interpretations given in the earlier papers may require revision.

It is of interest that as definite a case of corre-

[2] "The Chemical Basis of Axial Polarity in Regeneration." By Jacques Loeb. *Science*, N.S., vol. xlvi., p. 547. (1917.)

[3] "Rules and Mechanism of Inhibition and Correlation in the Regeneration of *Bryophyllum calycinum*," *Botan. Gazette*, vol. lx., p. 249. (1915). "Chemical Basis of Correlation. I. Production of Equal Masses of Shoots by Equal Masses of Sister Leaves in *Bryophyllum calycinum*," *ibid.*, vol. lxv., p. 150. (1918.)

[4] "The Law Controlling the Quantity and the Rate of Regeneration," Proc. Nat. Acad. Sci., vol. iv., p. 117. (1918.)

[5] "Influence of the Leaf upon Root Formation and Geotropic Curvature in the Stem of *Bryophyllum calycinum* and the Possibility of a Hormone Theory of these Processes," *Botan. Gazette*, vol. lxiii., p. 25. (1917.)

[6] "The Chemical Basis of Regeneration and Geotropism," *Science*, vol. xlvi., p. 115. (1917.)

lation by chemical messengers between organs in plants as that found by Prof. Starling and the present writer in the case of the pancreatic secretion in animals seems to be made out.[7]

W. M. BAYLISS.

THE PREVENTION OF VENEREAL DISEASES.

THE Executive Committee of the National Council for Combating Venereal Diseases, of which Lord Sydenham is president, has put forth a number of proposals for meeting the danger of a large increase of venereal diseases among the civil population when the troops are demobilised. The *Times* of November 25, in commenting upon the recommendations, states that there will be about 300,000 infected men on demobilisation. These will be distributed to every part of the British Empire, carrying with them the germs of infection. Rural districts in Great Britain and in the Colonies which have hitherto been free or comparatively free from these diseases will consequently suffer seriously.

There are thirteen proposals of the Executive Committee for preventive and curative treatment, but here it is intended to deal with the third recommendation only, namely, "Some means should be devised whereby medical practitioners are encouraged to diagnose venereal disease in patients, and also to give early preventive treatment." The only meaning which can be attached to this solitary proposal for prophylactic treatment is that the patient, having exposed himself to infection, should (if and when the opportunity offers) apply to a doctor encouraged to diagnose venereal disease, who would tell him what course to pursue to eradicate the disease, or possibly what he might have done to avert infection in the past, or how to avoid it in the future.

Medical science has shown that the two venereal diseases, syphilis and gonorrhœa, are due to specific living germs, which when once they are implanted in the tissues of the body are extremely difficult to eradicate. It is too late in a number of cases to avoid serious consequences if the patient has to wait for a diagnosis even by an experienced practitioner, although modern improved methods of curative treatment can do much. If science be consulted rather than sentiment, the *earliest treatment* would be advocated, such as the use of germicidal disinfectants in portable form as soon after exposure as possible to kill the organisms before they can enter the tissues of the body. This prophylactic treatment was first shown to be effective by experiments on animals, and such a method of prevention applied to human beings, first publicly advocated in a letter to the *Times* by Sir Bryan Donkin, is supported by a great number of medical authorities. It has long been adopted by the Navy, and has recently been introduced by the Army.

In *Public Health*, the official organ of the Society of Medical Officers of Health (No. 12, vol. xxxi., September, 1918), there are some interesting and important articles proving the value of earliest treatment in the prevention of venereal disease. Space is too limited to give full details, but the following results speak for themselves: Capt. Walker, of the Canadian Medical Forces, at a conference in Paris, stated that before the introduction of earliest disinfectant treatment the incidence of venereal diseases amongst the 5000 officers and men on leave in Paris during August and September, 1917, was 20 per cent. From November, 1917, to the end of March, 1918, after the introduction of immediate disinfection, only 3 per cent. of infections occurred. Capt. Walker, from his experience, strongly urged (1) prophylaxis for men, (2) prophylaxis for women, (3) a separation of the moral from the medical side of the question.

Likewise the experience of Col. Elgood at Port Said, and of the Australian and New Zealand forces, shows that this earliest disinfection is the most efficient, though not *absolutely* efficient, method of preventive treatment, because neither drunkenness nor indifference and carelessness on the part of the individual can be controlled. The arguments against the application of this earliest treatment to the civil population are twofold: (1) The injury to the individual and collective moral sense; (2) the impossibility of inducing the local authorities to advocate its practical application. As to these points, we may remark:—

(1) It is doubtful whether the fear of contracting venereal disease quenches the fire of sexual passion of youth or makes the viciously inclined virtuous. Again, there is the sentiment that such measures advocated by public authorities would be an incentive to vice, but against this must be placed the misery and suffering to countless innocent women and children which would arise if an efficacious mode of prevention is rejected upon moral grounds.

(2) During recent times necessity, and alarm for the future of the race, have swept away many prejudices, and, therefore, it is not surprising to find that the Warrington Town Council by a resolution has advocated the adoption of this earliest treatment, and copies of the same were forwarded to the President of the Local Government Board and the councils of the county boroughs of England and Wales. Well may the official journal of medical officers of health, commenting upon this resolution, assert that as a practical preventive measure this is undoubtedly the most important step that has been taken up to the present.

WORK AT THE NATIONAL PHYSICAL LABORATORY.

SINCE the opening of the National Physical Laboratory in 1902 remarkable growth has taken place not only in its material resources of buildings and equipment, but also in the number of the staff employed. The Annual Report[1] recently

[7] "The Chemical Regulation of the Secretory Process," Proc. Roy. Soc., vol. lxxiii., p. 310. (1904.)

[1] The National Physical Laboratory. Report for the Year 1917-18. (H.M. Stationery Office, 1918.) Price 2s. 6d. net.

issued, in directing attention to this development, states that at the end of 1902 the staff numbered twenty-six, with one superintendent, in addition to the director. In July, 1914, the number had increased to 187. At the present time the staff numbers 532, with six superintendents (including the secretary) and nineteen principal or senior assistants. Nearly fifty members of the staff are on military service, and four have sacrificed their lives in the cause of right. The staff remaining is almost exclusively engaged on war work, including researches of a confidential character as to which but little can be written.

The increasing dependence of the country on applied science, for both war and commerce, has been emphasised by recent events, and as a natural corollary the laboratory, with some other institutions, has become nationalised. The property of the laboratory has been vested in the Imperial Trust for the Encouragement of Scientific and Industrial Research. This transference includes the William Froude National Tank, from which results of great value to the Admiralty have been obtained.

During the past year there has again been a considerable increase in the work of the laboratory. In particular, the laboratory has been asked by the Ministry of Munitions to undertake the manufacture of a certain class of gauges and to extend largely the provision for the testing of glass vessels for chemical work. For these two objects new buildings are required and are being provided. The number of munition gauges passing through the laboratory for testing purposes has approached 10,000 a week. In the Aerodynamics Department the demands grow daily, and the laboratory has been required by the Air Ministry to extend the accommodation, especially by the provision of additional large air channels.

It is only possible to refer briefly to one or two points of special interest in connection with the work of other departments. It is proposed that the custody and maintenance of the primary electrical standards of the Electrical Standards Laboratory of the Board of Trade should be assigned to the National Physical Laboratory, so as to avoid the continuance of dual systems of standards. Since the early part of 1917, when the supply of clinical thermometers was taken over by the Ministry of Munitions, it has been found desirable that each individual thermometer should undergo test, and more than 3000 clinicals have been tested per week. This work has necessitated the provision of three new clinical test baths, the capacity of each bath being approximately 600 instruments per normal day. Two new pantagraphs of simplified design have been constructed for the marking of satisfactory instruments. A card index record is made of all thermometers passing through the department. In the optics division, in addition to the large amount of routine testing carried out on behalf of the Ministry of Munitions, valuable work has been done in testing the refractive properties of optical glass and in simplifying the methods employed in the calculation and design of optical systems. The record of the laboratory affords overwhelming proof of the national importance of both pure and applied physics, and this must inevitably lead to more adequate recognition of the professional status of the physicist.

NOTES.

IN June last the Board of Trade, in co-operation with the Ministry of Reconstruction, appointed a Committee "to examine and report upon the water-power resources of the United Kingdom and the extent to which they can be made available for industrial purposes." The announcement met with a cordial reception, for, with the exception of power installations at Kinlochleven, in the Scottish Highlands, and Dolgarrog, in North Wales, both for aluminium works, there is practically no utilisation on any appreciable scale of the natural water resources of the country, and the scope for development seems considerable. The names of the Committee commanded confidence. Sir John Snell is chairman, and, on the technical side, Sir Dugald Clerk, Mr. A. Newlands, and Mr. Philip Dawson are members; representatives of the Government and of the Associated Chambers of Commerce are also included. In the course of its investigations this Committee, which is still sitting, has found it desirable to delegate to a sub-committee its functions in so far as Ireland is concerned. Such a sub-committee has just been appointed by the Board of Trade, and it comprises Sir J. Purser Griffith (chairman), Dr. J. F. Crowley (vice-chairman), Mr. T. M. Batchen, Mr. G. Fletcher, Mr. L. J. Kettle, Lord Leitrim, and Mr. J. C. White, with Prof. H. H. Jeffcott as secretary. Although Ireland is not endowed to the same degree with favourable conditions such as those of the Highlands of Scotland, there are latent resources of water-power which are roughly computed by Mr. Newlands at between 200,000 h.p. and 350,000 h.p. These are to be found in connection with the great rivers which have a very considerable fall almost at the points at which they enter the sea. The reports of both Committees will be awaited with interest.

WHEN the British Scientific Products Exhibition was held by the British Science Guild at King's College, London, last summer, the hope was expressed that it would be transferred to great industrial centres in the provinces. Manchester promptly took steps to act upon this suggestion, and announcement can now be made that the exhibition will be opened at the College of Technology on December 27, and will remain open for a fortnight. The Right Hon. the Lord Mayor of Manchester is the chairman of the committee, and the detailed arrangements are in the hands of a strong executive committee, of which the principal of the college is chairman. The exhibition will follow the lines of that organised by the British Science Guild, but it will naturally be stronger in certain sections which represent industries centred in Manchester; in particular, the display of dyes and textiles is expected to afford a striking example of what British science and industry have been able to achieve in spite of war conditions, under the stimulus of the knowledge and enthusiasm of our scientific workers and manufacturers. Official exhibits will include a very striking collection of materials, models, and instruments used by and relating to the aircraft industry, which is being shown by the Aeronautical Inspection Department. The National Physical Laboratory, the Admiralty, and the Meteorological Office are also contributing depart-

mental exhibits of high interest, and the Gas Traction Committee will show much the same collection which raised such interest at King's College. The other sections comprise heavy and fine chemicals, including drugs, food products, metallurgical products, glassware, and electrical, optical, thermal, mechanical, and surgical appliances. There will also be a representative exhibit of British natural products which have been exploited since 1914.

A WRITER in the *Times*, directing attention to the fact that a large number of Royal Air Force officers will shortly be demobilised, suggests that they might profitably be employed in making an aerial photographic survey of the British Isles. He believes that this would prove useful to surveyors, architects, engineers, and others. While fully endorsing this writer's opinion that it would be unfortunate to lose the expert services of these flying officers, many of whom are better trained than any future airmen can hope to be, we cannot agree that a series of aerial photographs could be of great service to surveyors and engineers. Such photographs show the landscape from a new point of view, but they naturally lack the accuracy of carefully drawn topographical maps. On the other hand, such a survey might be of considerable value in the progress of flying for commercial and other purposes. Many attempts have been made to devise suitable maps for airmen, but even the best available leave much room for improvement. A series of photographs, or, better still, several series taken under varying atmospheric conditions, would be of great help to the cartographer in constructing the type of map of use in flying. A number of experienced officers and men might well find employment in this work.

DR. R. T. LEIPER'S investigations on Bilharziosis in Egypt and China, and those of various Japanese zoologists in Japan, have demonstrated the practical importance of the fresh-water molluscs as possible carriers of human disease. No indigenous species of Schistosomum, the Trematode parasite of Bilharziosis, is known to be commonly found in man in India, though sporadic cases of apparently autochthonous infection have been reported. The medical and sanitary authorities have, however, been prompt to recognise the danger of the introduction of *Schistosomum hæmatobium* into the country by means of infected persons returning from the front in Egypt or Mesopotamia. The Government of India has, therefore, instructed the newly constituted Zoological Survey of India to devote its attention to a survey of the fresh-water molluscs and their Trematode parasites. Dr. N. Annandale, the director, is studying the taxonomy, variation, and geographical distribution of the molluscs, and has commenced a series of tours to different parts of India proper and on the North-West Frontier, while Mr. S. W. Kemp is investigating the anatomy of the Cercariæ that infect the different species of water-snails and the possibility of infecting the latter with miracidia from the eggs of *Schistosomum haematobium*. Dr. F. H. Gravely is studying the life-histories of the molluscs, while Dr. Baini Prashad, formerly Superintendent of Fisheries, Bengal, has been appointed scientific assistant for the purpose of the whole inquiry. A generous grant of money has been made by the Indian Research Fund Association, and it has been arranged that the Zoological Survey shall work in the closest co-operation with the Indian Medical Service.

THE establishment of the Czech Republic, implying the severance of Bohemia and her neighbours, Moravia and Austrian Silesia, from the late Austrian Empire, has brought into prominence a race with remarkable gifts. Among men of science belonging to the Czech nation are the physiologist J. E. Purkyne, and a better-known name in England, the chemist Prof. Bohuslav Brauner, D.Sc. of Manchester. President Thomas G. Masaryk, lately in London, and now on his way to take up his duties at Prague, has long been known as a critical student of the English philosophers Hume, John Stuart Mill, and Spencer, besides Kant and Comte. Born in 1850, the son of Slovak parents, in Silesia, he began life as a blacksmith, but was soon able to cultivate his special gifts at Vienna and Leipzig. When the Czech University of Prague was opened in 1882 Masaryk was appointed professor of philosophy. From students we know that the standard required by him as an examiner is very high. Numbers of young men from Serbia and other Slav countries have passed under his influence. Prof. Masaryk's career has been that of a man of letters and politician rather than of a man of science, but as a sociologist he has written on suicide as a feature of modern European life, and on other social questions. A fearless investigator, Prof. Masaryk demonstrated that certain manuscripts purporting to be ancient Czech patriotic poems lately discovered, which were highly treasured and had found enthusiastic translators in many countries, were no more than adroit forgeries. In the notorious Friedjung trial of 1909 Prof. Masaryk conclusively proved that forged documents were made use of by the Austro-Hungarian Foreign Office. In December, 1914, he contrived to escape from Bohemia, where, like many of his colleagues, he must inevitably have suffered imprisonment, and has since championed the cause of Bohemian independence. Prof. Masaryk has lectured on Slav literature and sociology at King's College in connection with the School of Slavonic Studies. His inaugural lecture was on the problem of small nations in Europe. Both as writer and speaker President Masaryk is a thorough master of English.

INFLUENZA shows a further decrease in the number of deaths in London, the Registrar-General's return giving 942 for the week ending November 30. This brings the total deaths in London to 10,383 in the eight weeks of the epidemic. The deaths are still greatest at the ages of twenty to forty-five. Influenza has occasioned only 37 per cent. of the deaths from all causes in the week ending November 30, which is a lower rate than any previous week since that ending October 19, the percentage in the five weeks ending November 23 being respectively 47, 57, 57, 49, and 42. The epidemic is still very virulent in many country districts, and the returns for the ninety-six great towns of England and Wales, including London, show a slight increase in the number of deaths, many of the largest towns being less fortunate than London in this respect.

IN London the aggregate rainfall for the three months September, October, and November, which constitute the autumn, was, according to the Greenwich observations, 1·3 in. more than the normal. The excess was entirely due to the very wet September, when the rain measurement was 4·48 in. October had a deficiency of 1·2 in., and November a deficiency of 0·2 in. Rain was measured in London on twenty-five days in September, twenty-two days in October, and twenty-two days in November. The atmosphere throughout the autumn was generally humid, and the wind was drawn very greatly from the Atlantic. According to the monthly weather report for September, issued by the Meteorological Office, the weather was abnormally wet over the British Isles generally. In the West Riding of Yorkshire and in Lincolnshire, where the records extend over a period of more than

fifty years, it was not only the wettest September, but wetter than any calendar month of the year. In many places rain fell every day. At Greenwich the mean temperature for each of the autumn months differs only a few tenths of a degree from the normal. The mean of the maximum and minimum temperatures for September was 57°, October 50°, and November 43°. In September the thermometer ranged from 73° to 38°, October 64° to 31°, and November 59° to 29°. September had six days with the thermometer above 70°, October seven days above 60°, and November thirteen days above 50°. There were seven nights in November with the lowest temperature above the monthly mean temperature for the twenty-four hours; two of these occurred in the closing week. The monthly weather report shows that September was generally cold over the whole country, and the temperatures on September 29 and 30 were in many places lower than any previously recorded in September. At Greenwich the duration of bright sunshine for the three autumn months was about six hours more than the normal, the sun registering for 162 hours in September, 78 in October, and 69 in November.

THE American Ornithologists' Union has elected Dr. Walter E. Collinge, of St. Andrews University, a corresponding fellow of the society in recognition of his investigations on economic ornithology.

PROVIDED an essay deemed worthy by the committee of award be received, the College of Physicians of Philadelphia will, on July 14 next, award the Alvarenga prize, value about 50*l.*, for a paper not previously published upon any subject in medicine. Competing essays must reach the secretary of the college, Mr. F. R. Packard, 19 South 22nd Street, Philadelphia, on or before May 1, 1919.

THE death is announced, in his seventy-first year, of Prof. Pierre de Peyster Ricketts, professor of assaying at Columbia University, New York, from 1885 to 1893, and from 1893 to 1900 professor of analytical chemistry and assaying. Since his retirement from the University Prof. Ricketts had been the head of a firm of mineralogical consulting engineers. In 1876 he published "Notes on Assaying," the first book on the subject to be adopted as a text-book throughout the colleges of the United States.

WE regret to note that the death of Mr. Frederick Edwards is recorded in *Engineering* for December 6. Mr. Edwards was born in 1848, and his death occurred on November 27. His name is well known in engineering circles as the inventor of the air-pump bearing his name. Hundreds of engineers have designed air-pumps since the days of Watt, yet that invented by Mr. Edwards marked a great advance on all that preceded it, and this result was attained by a simplification of parts which left men wondering why it had not been effected years before. Mr. Edwards, after varied experience, commenced practising as a consulting engineer in 1871, and continued to do so down to the time of his death. He was a member of the Institutions of Civil Engineers, Naval Architects, and Mechanical Engineers.

THE death of Mr. R. J. Pocock from influenza and pneumonia at Hyderabad Observatory on October 9 removes a most promising and energetic astronomer at the age of twenty-nine years. Born at Harlesden, London, on January 23, 1889, Mr. Pocock at an early age showed keen interest in scientific subjects, especially in astronomy, his mental faculties being encouraged and stimulated by his father. At the age of nine he went to Christ's Hospital, West Horsham, leaving there in 1908 with a scholarship at Queen's College, Oxford, where he greatly enhanced his mathematical reputation, obtaining First Classes in the mathematical school in 1909 and 1912. He then gave a year's work at the University Observatory for the B.Sc. research degree, and in the same year became the senior mathematical scholar. Evidently being marked out for an astronomical career, Mr. Pocock was appointed the director of the Nizamiah Observatory in 1914, with the definite object of assisting the Santiago (Chile) Observatory in completing the zone $-17°$ to $-23°$ for the International Survey. This involved the taking of 720 good negatives in $-17°$ to $-20°$, and the consequent measurement and necessary reductions. At Mr. Pocock's death two of the zones (360 plates) had been finished and the results printed; the other plates had been so far completed that only 100 regions remained to be photographed and measured. This satisfactory result was the outcome of his own keen and energetic work, which instilled similar qualities in the Indian assistants. In addition to this somewhat tedious and absorbing work Mr. Pocock found time, in five years, to contribute fifteen papers to the Royal Astronomical Society (of which he was elected a fellow in 1914), four of which were read at the November meeting—a month after his death.

MR. E. A. MARTIN, president of the Croydon Natural History Society, has reprinted an interesting lecture on Anglo-Saxon remains in that neighbourhood. The earliest of these are a series of graves with cremated bodies found near Mitcham and Hackbridge. Near Mitcham have been found cases in which it is assumed that widows were immolated with their dead husbands. Interments in tumuli on Farthing Downs have provided some interesting artifacts. Near Thornton Heath railway station a stone coffin with a hoard of coins was unearthed. The local museum contains a fine collection of Saxon remains found at Croydon in 1894. Saxon occupation of the district is illustrated by a number of local place-names.

IN the *Scientific Monthly* (vol. vii., No. 5, November, 1918) W. La Rue discusses the problem of testing for intelligence, with special reference to the Army. The intelligence test is no longer of merely academic significance with the object of classification; it is not a museum arrangement of individuals that is the goal, but it is really necessary for practical purposes, since we are often now in the position of requiring to know what people will or can do in a given situation. The criterion of a test and of a tester is the possibility of predicting from the subject's behaviour with regard to the test how he will behave with regard to other problems. Just as we can prove a machine by testing its various parts, so may we test for intelligence. The alternatives are not laboratory tests *versus* no tests, but laboratory tests as against the casual test of individual opinion, which has many times been found to be fallible. In order that we may get more definite results, we ought to test, not only for general intelligence, but for special situations as well. The author maintains that the results of recent work done on these lines in the American Army are very promising. Although intelligence is not the only factor desirable in a soldier, line officers rating more highly obedience, adaptability, and dependability, yet from experiments it is found that if a man is placed according to his intelligence, he will be found to be placed substantially according to his camp value. The author believes that wherever there are problems of

mental classification and of assignment to a person of the most suitable occupation, there the psychometrist will be of service.

MAMMALOGISTS will welcome the description of the mammals from the Korinchi country, West Sumatra, by Messrs. H. C. Robinson and C. Boden Kloss, which appears in the Journal of the Federated Malay States Museums (vol. viii., part 2, 1918), not only because it deals with the most extensive collection yet made in the island proper, but also because of the very careful way in which the work has been done. Six species are described for the first time, while a number of others, of which temporary diagnoses have already appeared, are now described in detail. Adults and young and variations attributable to age, sex, and season or to individuals are all carefully described, as also are differences attributable to altitude.

A DELIGHTFUL essay on the gannets of Bonaventure Island by Mr. P. A. Taverner appears in the *Ottawa Naturalist* (vol. xxxii., No. 2). Mr. Taverner describes the breeding colonies, not only of the gannets, but also of the guillemots, puffins, and petrels associated therewith. An attempt, he remarks, has been made to make this spot a perpetual bird reserve, but the efforts of the Conservation Commission in this direction have met with only a cold response from the local population. It is to be hoped that the Dominion authorities will not relax their efforts in this matter, if only to put an end to the wanton destruction caused by "sportsmen" who seem to take a delight in slaughtering the birds without making any use whatever of their victims, which include thousands of young left to die of starvation by the death of their parents.

THE peach-shoot borer (*Laspeyresia molesta*, Busck.) causes considerable damage to peach-trees, as well as to other rosaceous trees, in Japan. An interesting account of the biology of this insect is given by Messrs. Harukawa and Yagi in the *Berichte des Ohara Institutes* (Bd. i., Heft 2, pp. 151–70). On the south coast of western Japan this insect passes through five generations in a single year, but the number of annual generations appears to be determined to a greater or less extent by the climatic conditions. The duration of the egg stage was found to be 2–4 days, of the larval condition 11–15 days, whilst the insect remained in the pupal state for 6–10 days. At the onset of cold weather the larvæ spin their cocoons, pass the winter as caterpillars, and only assume the pupal state the following spring. The young caterpillar, as soon as it leaves the egg, makes its way to the base of a still unexpanded leaf of a young shoot of the peach-tree, bores its way into the pith, and destroys this from above downwards. The insect also attacks the fruit of the peach, pear, etc.

RADIO-METALLOGRAPHY is the subject of a short article by Mr. Thorne Baker in the *British Journal of Photography* for November 29. By using a modern high-tension transformer and Coolidge tube, heavy currents of extreme penetrating power can be produced, and render it possible to take photographs through 4 in. of hard steel. A hole 1/64th of an inch in diameter and of the same depth, drilled in the upper surface of a block of steel 2 in. thick, will show distinctly in a good radiograph with an exposure of about two minutes, so that the usefulness of the method for showing flaws and cavities is very promising. Installations for testing by this method have been put up by many large engineering firms. The protection of the operator is a rather different problem from that in ordinary medical work, and it is preferable to control the apparatus from a separate room or cabin, the partition being lined with heavy sheet-lead, a thick lead-glass window being provided, and covered with a lead shutter immediately the tube is seen to be acting properly.

THE subject of the Traill-Taylor lecture, which was delivered this year by Mr. F. Twyman, of Messrs. Adam Hilger, Ltd., was "The Use of the Interferometer for Testing Optical Systems." A full account of the lecture is published in the Journal of the Royal Photographic Society just published (November). Mr. Twyman's experience confirms Lord Rayleigh's rule (which was derived from the calculations of light intensity distribution for a few specific cases) that an optical instrument cannot properly be described as of first quality if it produces aberrations greater than a quarter of a wave-length. Many photographs of interference patterns produced by aberrations are given in the report. In order to utilise the result of the test, the contour lines of the pattern are marked during the observation on the surface of the lens with a paint-brush, and then the part indicated as the highest is polished off, gradually extending the area of polishing to the further contour lines. Mr. Twyman says that this is "not at all a difficult or very lengthy operation, and one which I have performed this morning, before my usual breakfast-hour, on a very similar lens." We are therefore justified in hoping that the near future will enable us to get optical systems much nearer to perfection than those to which we have been accustomed, without any notable increase in their cost.

THE importance of kinematograph propaganda has been fully realised by America and Germany, and it is quite time that its usefulness was appreciated in England. As the Industrial Publicity Service, Ltd. (Hampden House, Kingsway, W.C.2), points out in a recent brochure, 90 per cent. of the films shown to the British public are of foreign origin, with the result that the conceptions of life which a multitude of our people derive are those as represented principally in America. Among the objects of the Industrial Publicity Service (which is a non-profit organisation controlled by various manufacturers' associations) are that it should serve as a medium by which the general public at home and abroad should be better informed of the development of British industries through the Press, and that it should organise kinematograph displays, etc., showing the importance of improved methods of production on the well-being of the population. In this respect the claims of British science as applied to industry should receive attention, so that other nations may realise, through the medium of the kinema, what Britain has accomplished in that direction. If this method of propaganda were judiciously resorted to, it would go far to maintain the prestige of the British nation among our Allies and neutral countries. The main thing is to make films of this kind popular and interesting, and it could be done without detracting in any way from the dignity of science.

IT is well known that American shipbuilding yards have made extensive use of bridge-building and other suitably equipped works for the fabrication of parts of vessels. Similarly it was necessary to utilise for the propulsion of ships so built every type of standard engine which could be said to be in any way suitable for marine work. From an article in *Engineering* for November 29 we learn that American ships are being

equipped with almost every known type of oil-engine, utilising in consequence in the case of several types various means to reconcile conditions of maximum propeller and engine efficiency, such as mechanical gearing and electric transmission. The powers so far are relatively small, 200 h.p. per cylinder being the maximum recorded. In one case the main Diesel engines are of the Willans and Robinson type, with six working cylinders 12 in. by 18 in., and develop 320 b.h.p. at 250 revs. per minute. This speed is reduced by gearing to 100 revs. per minute at the propeller. This method has a number of advantages in the application of Diesel engines to marine propulsion. The problem is not quite analogous to mechanically geared turbines, and the question of the ability of mechanical gearing to stand up to its work under conditions of uneven turning moments is the principal one that can be raised in connection with this application of gearing.

THE latest catalogue (No. 176) of Messrs. W. Heffer and Sons, Ltd., Cambridge, gives particulars of upwards of 1300 works dealing with a variety of subjects. Many of the books offered for sale are first editions, and not easily obtainable. The section devoted to science and mathematics is not lengthy, but the catalogue is worthy of the attention of readers of NATURE because of it and that headed "Books for Librarians." In the former section we notice long runs of *Biometrika*, the British Association Reports, the *Conchologist*, the *Philosophical Magazine*, vols. i. to xcii. of NATURE, and complete sets of the Proceedings of the Physical Society of London and the Proceedings of the Royal Society of Medicine. In the section of "Books for Librarians" are to be found a complete set, to 1914, of the *Journal of Physiology* and long series of the Journal of the British Astronomical Association, Memoirs of the Royal Astronomical Society, the Journal of the Royal Geographical Society, the *Geological Magazine*, the Journal of the Royal Microscopical Society, and the Proceedings and Transactions of the Zoological Society of London. The catalogue will be sent free upon application.

THE next volume to be published in *Messrs. Constable and Co.'s* "Staple Trades and Industries" series will be "Tea," by D. Hunter. Other volumes are in preparation. *Messrs. Henry Frowde and Hodder and Stoughton* announce "War Neuroses and Shell Shock," Lt.-Col. F. W. Mott, illustrated; "Orthopædic Effects of Gunshot Wounds and their Treatment," Capt. S. W. Daw; "Medical and Surgical Aspects of Aviation," H. Graeme Anderson; "The Anatomy of the Peripheral Nerves," Lt.-Col. A. M. Paterson; and "The Early Treatment of War Wounds," Col. H. M. W. Gray. *Messrs. Heinemann (Medical Books), Ltd.*, will publish shortly "Pensions and the Principles of their Evaluation," Drs. Ll. J. Llewellyn and A. Bassett Jones. *Messrs. Longmans and Co.'s* new list includes "Naval Architects' Data," J. Mitchell, edited by E. L. Attwood; vols. ii. and iii. of "A System of Physical Chemistry," Prof. W. C. McC. Lewis; vol. i. of the third edition of "British Birds," written and illustrated by A. Thorburn; and new editions of "Recent Advances in Organic Chemistry," Dr. A. W. Stewart, and "Dental Surgery and Pathology," J. F. Colyer. *Messrs. Witherby and Co.* announce the publication, in serial form, of "De Vogels van Nederland," by Dr. E. D. van Oort. The work will be issued in forty parts, and contain four hundred coloured plates. It will be written in the Dutch language, with the scientific names given, in addition, in English, French, and German.

OUR ASTRONOMICAL COLUMN.

DWARF STARS.—In the course of an article which appears in the November issue of *Scientia*, Dr. A. C. D. Crommelin discusses the evidence which suggests that dwarf stars are the most numerous class of stars in space. Such stars, which are to be regarded as small in volume rather than in mass, may comprise about three-fourths of the total number of stars, but only a few of them are known, because at a very moderate distance they become too faint to be included in our star catalogues. As examples of dwarf stars, Barnard's runaway star in Ophiuchus and the "Proxima Centauri" of Innes are described in detail. Barnard's star has a proper motion of 10·3″ per annum and a parallax of 0·525″, and is unique as being the only star having a proper motion which is sensibly increasing as a result of diminishing distance. The velocity of approach is about 100 km. per second, and this would cause the annual proper motion to increase by 0·10″ per century, which is in satisfactory agreement with the available observations. The spectral type of the star is M*b*, and its luminosity 1/2000 that of the sun. From its high speed a small mass is probable, and if the star be assumed to have a mass one-eighth that of the sun, and a somewhat greater density, the surface brightness would be 1/170 that of the sun.

THE SUN'S ROTATION.—The application of the spectroscopic method to the investigation of the sun's rotation has led to such different results as to have suggested to several observers that the rate of rotation must be variable. Mr. R. E. De Lury, however, has maintained for some time that the differences in the results are not of solar origin, but arise from varying amounts of atmospheric haze, which superposes an unmodified solar spectrum on the displaced spectra at the solar limbs. He returns to the subject in a further discussion of the observations made at Ottawa (*Astrophys. Journ.*, vol. xlviii., p. 195), and concludes that there is at present no sound reason for believing that the rate of the sun's rotation is variable. In general, high values of the rotation were obtained during brighter conditions, and low values during hazier conditions. Thus the low values of rotation obtained by Evershed and Royds in 1912–13 may well have been due to the haziness produced by the Katmai eruption in June, 1912, which also caused a great reduction in the measured values of the solar radiation.

THE CANADIAN 72-IN. REFLECTING TELESCOPE.—The great reflecting telescope which has been erected by the Canadian Government on Observatory Hill, near Victoria, B.C., has been finally completed by the installation of the optical parts, and is now in regular successful operation. Further interesting details of the instrument are given by the director, Dr. J. S. Plaskett, in a communication to the Journal of the Royal Astronomical Society of Canada (vol. xii., p. 399). The disc of glass, 73½ in. in diameter, about 13 in. thick, with a central hole 6 in. in diameter, and weighing nearly 5000 lb., was successfully cast and annealed at the works of the St. Gobain Glass Co., in Charleroi, Belgium. It was completed in July, 1914, and was fortunately shipped from Antwerp about a week before the declaration of war. The grinding and figuring of the mirror to a focal length of 30 ft. was carried out by the Brashear Co., at Pittsburgh. The maximum deviation of the final curve from theoretical perfection amounted only to about one-eighth of a wave-length, or double the accuracy required by the specifications. The secondary mirror

for using the telescope in the Cassegrain form is 20 in. in diameter. The mounting of the telescope is of the "English" pattern, and permits the observation of all parts of the sky. It is satisfactory to find that the performance of the optical parts, the mounting and the dome, and the character of the seeing are quite equal to, and even exceed, expectation. With the single-prism spectrograph now in use excellent spectra of stars of photographic magnitude 7·0 are secured in about twenty-five minutes, and the change from one star to another can be made in less than five minutes. Canada is to be congratulated on having obtained so fine an instrument for astronomical research.

THE EDUCATION ACT OF 1918 AND ITS POSSIBILITIES.

THE Education Act, which received the Royal Assent on August 8, contains within it potentialities of the highest moment for the well-being of the nation, and only needs goodwill and a progressive spirit to realise to the full the ideals of its chief promoter. On the same day that it became law the Board of Education put into legal effect thirty-three out of the fifty-two sections which comprise the Act, some of them of considerable importance as paving the way for the more revolutionary changes which the Act is ultimately designed to accomplish.

The chief sections made immediately operative are intended (7) to remove the limitations as to expenditure from the rates by the council of a county for the purposes of education other than elementary; (8) to empower the education authority to require the attendance of any child at special classes or courses of practical instruction or demonstrations held in other than the school buildings; (15, 16) to enable the authority, upon the report of the medical officer, to prohibit the continued employment of a child, or to alleviate its conditions, where it is shown to be prejudicial to the health and physical development of the child, and to impose penalties on an employer for breach of its by-laws; (17) to authorise the authority to maintain, or to aid the establishment of, school camps, centres, and equipment for physical training, playing fields, school baths and swimming baths, and other facilities for social and physical training in the day or evening; (18) to extend the provision of medical inspection and treatment to other than elementary schools so as to include secondary and continuation schools and other schools and institutions provided by the education authority; (19) to provide or aid the provision of nursery schools for children between two and five years of age, or to a later age, so as to ensure the health, nourishment, and physical welfare of such children; (21, 24) to make suitable provision, inclusive of board and lodging, so as to enable children in exceptional circumstances, such as the remoteness of their homes, or other special conditions, to receive the full benefit of efficient elementary education, and to make agreements with the parents accordingly, and to provide, in addition to scholarships for higher education, allowances for maintenance; (23) to empower the education authority to aid research with the view of promoting the efficiency of teaching and advanced study, and of aiding investigation for the advancement of learning; and (34) to acquire land compulsorily for educational purposes, substituting the authority of the Board of Education for that of the Local Government Board; and, further, (35) to provide a public elementary school immediately outside its area for the use of children within its area.

A very important provision is made in sections 45, 46, and 47 whereby by an Order in Council the Crown can appoint an official trustee or trustees of educational trust property, which property is relieved of the restrictions imposed by the Mortmain Acts, and its control is now vested in the Board of Education and differentiated from all other charitable trusts. The removal of the limitation in the Act of 1902, whereby the council of a county shall not exceed in its expenditure in respect of higher education a sum out of the rates exceeding 2*d*. in the pound—a provision the reason for which it is difficult to understand, seeing that the county boroughs had unlimited powers—will enable the more progressive among these authorities to make much more extensive provision for advanced education; to provide efficient and accessible secondary and special schools in rural areas; to increase the number of scholarships and the means of maintenance, since no child is to be debarred from receiving the benefits of any form of education by his inability to pay fees; to secure due facilities for medical inspection and treatment for children and young persons in secondary and in continuation schools; and to provide all desirable means and opportunities for ensuring social and physical training among those pursuing the various branches of higher and continued education. Already the more advanced and enterprising of the county authorities are busy considering schemes of educational development with a view to their immediate application.

The mandatory powers now assured by the Act to the Board of Education will enable it to require from all local education authorities the provision of schemes for the development and comprehensive organisation of education within their areas, to which, when approved, it shall be the duty of the several authorities to give effect. This marks a great advance upon the Act of 1902, which in this regard was largely permissive in its requirements, of which many laggard authorities took advantage.

The provision of nursery schools will ensure a very large saving of infant life and a much more vigorous child-population, since the children in poor and crowded districts, especially in the industrial areas, will be better fed and cared for and their infantile ailments dealt with effectively. Nor will the medical inspection and treatment of the adolescent in the continuation schools be less beneficial, securing as it will, at a critical period of life, that desirable attention to the health and vigour of the body which will ultimately ensure a much higher standard of virility in the adults of the nation. There is abundant evidence since the advent of the war of the avoidably large percentage of the youthful population who are far below a satisfactory standard of health and vigour arising from neglect in childhood and early youth.

So soon as the Act comes into full operation (which, judging by the course of events of the present war, may happily be within a few months), half-time, which prevails mainly in the textile districts of Lancashire and Yorkshire, and all other exemptions enabling children under fourteen years of age to leave school, will be abolished. Provision is made in the Act for a large extension of the sphere of the elementary school, fees in which are abolished. Central schools may be established in which at appropriate stages practical instruction suitable to the ages, abilities, and requirements of the children must be set up. Courses of advanced instruction for older pupils desirous of remaining at school beyond fourteen years of age must be provided, and measures taken for the preparation of children who desire further education in schools other than elementary and for their transference thereto.

Provision must be made for a sufficient supply of continuation schools, free of all fees, for young

persons between fourteen and eighteen years of age who are in employment, the instruction in which shall extend, within the working day, to 280 or 320 hours in each year, at the option of the local authority, and be distributed over such times and seasons as may seem desirable; the regulations in respect of young persons between the ages of sixteen and eighteen are, however, not to apply within seven years of the appointed day. When in full operation these continuation-school courses will deal with some two and a quarter millions of young people who have hitherto entirely failed to continue their education. It is gratifying to note that this feature of the Act is already being brought into effect by many large firms in the North of England. The Act further encourages the co-operation and combination of neighbouring authorities in any schemes, especially those relating to higher education. The crux of the Act lies in a due supply of efficient teachers, but with the offer of better salaries, improved prospects, and adequate pensions this essential may be assured.

THE PUBLIC HEALTH.[1]

THE annual survey of the public health of England and Wales by the Medical Officer of the Local Government Board recently issued contains matter of considerable general interest.

The first few pages of the report are devoted to a useful review of events since 1871, the year in which the Local Government Board was established. The data given show clearly the improvement of the public health since that year. For instance, the total death-rate for 1911–15 is from 42 to 50 per cent. less than that obtaining in 1871–80 for all ages up to forty-five, and at every subsequent age-period a substantial reduction has been secured. The number of lives saved *every year*, due to reduction of the death-rate, between 1871–80 and 1910–12 averaged 234,955, and the average expectation of life has increased by ten years for males and by nearly eleven years for females.

Almost all diseases during this period show a reduced mortality, the exceptions being influenza (which was not prevalent in 1871–80), diphtheria, and cancer. Some of this registered increase in the crude death-rate from cancer arises from the higher average age of the population, for cancer becomes more frequent as age advances. A still larger proportion is due to more accurate certification of cause of death, but it is still an open question whether the whole of the increase in the mortality from cancer can be thus explained. Whether so or not, cancer remains one of the chief causes of death in man.

The death-rate in young children has been markedly reduced, and the prevalence of typhoid or enteric fever has also rapidly declined since 1911. The former fact is the best index of combined social and sanitary progress, the latter of general sanitary progress.

The needs of the future are next briefly considered; they are regarded as coming under three principal headings—(1) research into the causation of disease on a much larger scale than has hitherto been attempted; (2) extension of communal action for the prevention and treatment of disease, and more complete training of the medical profession for this work; and (3) simplification and strengthening of administrative machinery.

An important section on maternity and child welfare follows. Attention is directed to the declining birth-rate; in 1917 it was only half that of 1874. In spite of a considerable saving in child-life, the rate of survivors to age five of the total population is a steadily declining figure—from 27·1 per 1000 in 1874 to 19·6 in 1916. The effect of this will be that "unless economic or other considerations having an opposite influence come into play, the population, apart from immigration, will ere long become stationary, the birth-rate not more than counterbalancing the death-rate." Infant mortality, including still-births, is discussed. The infant mortality in 1917 for the whole of England and Wales was 97 per 1000 births, as compared with 91 in 1916, the lowest recorded rate. Judging by the past, it is considered that we may anticipate a reduction of the national rate of infant mortality to 50 per 1000 births—a rate already attained in some parts of the country and in New Zealand as a whole—but this desirable end can be secured only by improving the welfare of every mother.

Succeeding sections of the report deal with (*a*) the prevention of acute infectious diseases, from which we learn that 178 indigenous cases of malaria occurred in 1917; and (*b*) the prevention of chronic infectious diseases, of which tuberculosis is the most important. The total deaths from pulmonary tuberculosis have increased since 1913, and in 1917 the increase was 6058, or about one-sixth more than in 1913. This increase was greater among females, due probably to their more extensive employment in industrial occupations with conditions of strain and overcrowding.

The work of port sanitary authorities is surveyed. Rat destruction has been carried out at the principal ports in view of the connection of these rodents with plague infection; some 110,000 rats have been destroyed in the ports of London, Liverpool, and Hull, and of some 12,000 rats specially examined five were found to be plague-infected.

Appendices contain the reports of inspectors on outbreaks of infectious disease, statistical tables, etc.

R. T. H.

[1] Forty-seventh Annual Report of the Local Government Board, 1917–18. Supplement containing the Report of the Medical Officer for 1917–18.

AN INSTITUTE OF PHYSICAL AND CHEMICAL RESEARCH FOR JAPAN.

THE idea long cherished by some of the scientific men in Japan of establishing a national institute of scientific research has, in part at least, been realised—in part, first, because the Institute of Physical and Chemical Research which came into existence as a legal body in March, 1917, does not, as its name implies, cover the whole field of science; and, secondly, because the fund now being raised in its support is not quite sufficient to place the institute upon such a financial basis as was at first contemplated. Nevertheless, it promises a fair start, and, with wise administration and a judicious choice of the staff, it is hoped that the institute may do some useful work for the progress of science and industry.

The outbreak of the great war in 1914, which at once cut off the import, mainly from Germany, of dyestuffs, drugs, and other products of daily necessity, and at one time almost gave rise to a panic in business, was responsible for producing a profound change in the mental attitude of the Government officials, the business men, and, in fact, the whole nation towards science. Those who had in vain been preaching the supreme importance of cultivating science with all activity and pleading for public support now saw at once that the right opportunity presented itself, and lost no time in drawing up a definite plan for an institute of physical and chemical research—a plan which, though not ideal, was deemed to be practicable and to meet the most urgent need. This, fortunately, obtained the cordial support of some of the most influential and public-spirited of the business men, particularly of Baron Shibusawa, and afterwards

also of the Government, of which Count Okuma was at the time Premier.

According to the plan, which was ultimately adopted, a fund of 5,000,000 yen (10 yen=1*l.*) was to be raised by public subscription. Of this sum just about one-half has already been promised, and is being paid in, almost wholly by those who have either commercial or industrial concerns in Tokyo and Yokohama. The other half is, with good reason, expected to be contributed within a few years by those in Osaka, Kobe, and other large and wealthy cities in the south-western districts. The plan also included an application for a Government subvention, and, in accordance with the Bill passed by the Diet in its 1915–16 session, the Government is giving the institute a subvention of 2,000,000 yen in ten years, whilst H.M. the Emperor has made a gift of 1,000,000 yen for promoting the object of the institute. The total fund, supposing that the public subscription comes up to the expected sum, would thus amount to 8,000,000 yen, of which about 2,500,000 yen has to be invested in land, buildings, and equipment. But since the interest accruing from the fund is calculated to exceed the annual expenditure for the first six or seven, or even more, years, when the activity of the institute cannot of necessity be very great, it is expected that at the end of ten years there will be left over a fund of about 6,000,000 yen, which, calculated at 5 per cent. interest, would yield an annual income of 300,000 yen. To this extent, therefore, the institute would be self-supporting, and it is roughly estimated on this basis that the number of staffs of all grades and of mechanics, laboratory boys, etc., would be between 100 and 120 in all. But it is evident that the institute must grow in both size and activity, and that, therefore, the above income would soon be found to be inadequate to meet the necessary expenses demanded by this growth. As the institute grows in activity, however, its importance will be made more and more evident, and it is believed that there would then be no great difficulty in obtaining more money.

Passing from the financial aspect of the institute to its organisation and work, it may be mentioned that its administration is entrusted to a board of managers, of whom one is a general director and another a vice-director. The scientific work of the institute is carried on in the two departments of physics and chemistry, each of which has a departmental director and a number of staffs, graded as fellows, associate fellows, and assistants. The departmental directors, who are also fellows, superintend the research work in their own departments, but each fellow is expected to undertake researches on his own account, either by himself or in collaboration with other fellows, associate fellows, or assistants. Some of the associate fellows may also carry on independent work. A greater number of the researches would then be of an individual character, but there would also be several cases in which certain problems selected by the institute would be dealt with from all points of view—cases in which a combined effort of a number of fellows and associate fellows, both physicists and chemists, would be required.

It is expected that, in course of time, there would be formed a certain small number of sections in each of the departments of physics and chemistry, with a chief in each section, such, for example, in the chemical department, as the section of inorganic and physical chemistry, and the section of organic and biological chemistry. It is not in contemplation, however, to form separate sections for so-called pure and applied science, still less for such subdivisions as are generally made in applied chemistry, the policy of the institute being to attack industrial problems from a broader and essentially scientific point of view. In this connection it may be mentioned that the institute is expecting a number of special industrial problems to be constantly brought forward for solution by manufacturers, and that the institute would gladly undertake the investigation of such problems, somewhat on the same lines as are followed at the Mellon Institute in Pittsburgh. Such a policy would, it is believed, not only contribute more directly to the development of special industries, but also bring the institute into closer touch with the manufacturing world—a state of things which is evidently essential for bringing about a satisfactory federation of science and industry.

The greatest and most fundamental difficulty experienced in Japan is the lack of really capable researchers, and one of the most important objects of the institute is to train young men in original research. For this purpose a certain number of university graduates are annually elected to research scholarships, which are tenable for two years, preference being always and strictly given to those candidates who have shown signs of originality and development rather than to those who have most distinguished themselves in examinations. During the two years of his term a scholar works at some original research either in the university or in the institute, and if at the expiration of the term he proves himself to be sufficiently satisfactory, and also desirous of getting a situation in the institute, then he will be appointed an assistant. If, however, he prefers to go elsewhere, he is quite free to do so. The institute loses nothing by this, for its object is to train young men in research work, no matter whether they may or may not become members of its staff. An assistant receives further training in the institute by constantly associating himself with the work of one of the senior members of the staff, and is, on being found to be sufficiently capable, promoted to an associate fellowship, and ultimately to a fellowship, with a proportionately increasing salary. A few of the associate fellows are annually sent abroad for further training, there being three (Asahara, Nishi-Kawa, and Takamine) in the United States at present.

The laboratories and workshops of the institute will be built upon a site which has been bought in a northern district of Tokyo, not far from the university, but it will be some years before these are completed. Meanwhile, the research work of the institute is being carried on in the Universities of Tokyo, Kyoto, and Sendai, the authorities of these universities having kindly placed some of their rooms at the disposal of the institute, and the salaries of those engaged in or assisting research for the institute, as well as expenses for instruments, chemicals, etc., being borne by the institute.

It may be added that the reason for making the institute independent in its organisation of either the university or the Government was to enable its staff to devote the whole of its time and energy to research, free from any tutorial work or the drawbacks attending a Government institution.

THE LABORATORY IN THE SERVICE OF THE HOSPITAL.[1]

UNTIL recently the fundamental importance of laboratories as a weapon of offence against disease has received only sporadic recognition, and their pioneer work has not been fostered by any firmly directed policy of encouragement. But the necessity for safeguarding a gigantic army against epidemics—always the supreme menace—has brought into a

[1] Abridged from an address delivered at the opening of the winter session of the Medical School of the Middlesex Hospital on October 1 by Dr. C. H. Browning.

prominent light the indispensable functions of the laboratories, thanks to which, in the brief interval between the South African campaign and the present war, "disease, not battle, digs the soldier's grave" has ceased to be a terrible truth. As regards general recognition, however, the laboratory suffers from the obscurity which surrounds its work. The might-be victim of epidemic disease is unlikely to entertain a lively sense of gratitude on account of his deliverance from the attacks of such minute enemies as the germs of enteric fever or cholera.

Modern Surgery—The Break from the Past.

A superficial observer would discern that in one great particular the hospitals of to-day differ from those of even the near past. I refer to the operations of the surgeon. It was not until towards the middle of last century that the discovery of anæsthetics enabled the surgeon to operate as the nature of the disease demanded, but this liberty of action at first brought small advantage, since wounds became the port of entry for septic infection into the body—a malady often far more deadly than the ailment which it was designed to cure.

Now all this is changed; but no gradual evolution of ideas of common cleanliness, no "broadening down from precedent to precedent," effected this revolution. We owe it to Pasteur, who made the fundamental discovery that putrefaction was due to microscopic living organisms, and to Lister, who secured the triumph of Pasteur's principle in its application to surgery.

Since this work originated from the laboratory, and as its outcome was pre-eminently practical, it is necessary to consider what the terms "science" and "the laboratory" stand for in relation to medicine. In some quarters even yet the suspicion lingers that science and practice are antagonistic, and that biological science will not admit of application to the affairs of everyday life, among which must be reckoned the healing of the sick. Like most other fallacies, this one contains the vestige of a truth, for there are not lacking scientific pedants who disregard what is practical, and who shirk responsibility by eliminating from their interests whatever promises an outcome valuable to mankind. The spirit which animates true science or pure science, as it is often called, is, of course, the search for truth for its own sake, and without, in the first place, entertaining any notion of practical application. It has seldom happened, however, that a new truth remained long without being harnessed to some cart of progress.

Enterprise and Applied Science in Medicine.

While the heaven-sent gift which leads to the discovery of great new truths is bestowed upon only a few individuals of every generation, there is, short of genius, a most precious faculty which is much less rare, and which perfects itself through opportunity and encouragement, the spirit of enterprise, which works out improvements and elaborates new practical applications. It is given to genius to open a door in the blank wall of ignorance by which current knowledge is confined; then enterprise has the courage to pass through that door and laboriously to tread out fresh paths of progress, in spite of prejudice that stands by and sneers. Commercial gain is the usual incentive to enterprise, and the multitude of material conveniences which to the casual eye constitute the distinguishing feature of our modern civilisation testify to the results. But the prospect of commercial advantage is by no means the sole spur which stimulates enterprise, as the long line of Arctic explorations abundantly proves. It is remarkable, however, how little of such enterprise devoted to the advance of medicine there has been until recently, and that far less attention has been paid to the preservation of health than can be commanded by such problems as the production of a dye, the design of an aeroplane engine, or the quest for the North Pole. The explanation of this extraordinary neglect appears to lie in the fact that all enterprise demands for its pursuit the outlay of capital, and that human nature craves an obvious return for its expenditure, whether it be in the form of dividends from a company exploiting some industrial invention or the thrilling story of an explorer's hairbreadth escapes. The laboratory worker, perhaps fortunately for his honesty, is a novice in the art of publicity, and his thrilling story is seldom told; also the results of his achievements are preventive, and so destroy or forestall the very evidence which would continue to proclaim the necessity for their intervention.

When we consider what is the actual sphere of science and the laboratory in medicine, we find that the laboratory worker may be more or less excluded from the cognisance of the symptoms and treatment of the diseased individuals owing to a preconceived notion of his functions on the part of those who control him; whereas the association should be most intimate. Where disease is under consideration, science lies both in method and in experiment. Accordingly, everything that conduces to precision in the investigation and treatment of disease is scientific. The scientific memory substitutes the card-index for the tablet of the mind and replaces impressions by statistical surveys, for the value of an argument depends on the validity of premises. We should probably object to receiving a pound of sugar measured "by the eye" of the vendor, yet until recently the world was content to accept decisions as to the health of its body based mainly on impalpable impressions. Experiment, in addition, is the essential weapon; for Nature, when left to herself, usually presents her problems in so great a tangle that a solution is impossible until she is, so to speak, bridled by the experimenter, who then observes the paths she traverses. It is but natural that such activities should be centralised in a particular department, and that certain workers should by inclination and training devote themselves specially to such tasks; but whoever has made the serious attempt to coax a secret from Nature obtains an outlook the value of which he cannot realise until he enjoys it. So it is an ideal—by no means unrealisable—that every student should be a participator, even though to a small degree, in the joys of discovery, and should receive such practical insight into the methods and the results of scientific inquiry as will enable him later on to weigh evidence and to understand soundness of proof.

Past Achievements of the Laboratories.

The recognition of the causes of bacterial diseases marked the first step of progress. The methods necessary for the prevention of infective diseases then often followed as a corollary. Thus the practical abolition of typhoid fever in the Army by means of preventive inoculation and the detection of carriers, also the prevention of tetanus by the administration of anti-tetanic serum to the wounded, are achievements the magnitude of which it is not possible to exaggerate. It is a literal fact that if any of the combatant countries neglected to act upon the established teachings of bacteriology, defeat would overtake it on that account alone. The calamities which ensue when the disorganisation due to war destroys arrangements essential for the preservation of hoarded masses of human beings have been terribly illustrated in Serbia and Rumania. The plague of lice, which

infested and throve among those unfortunates, harboured the more terrible plagues of typhus and relapsing fever. Although scientific investigation had shown conclusively that destruction of lice enabled typhus fever to be extinguished, and that relapsing fever could be cured by salvarsan, neither of these facts could be acted on. "And now arose a situation that can only be compared to the description in Defoe's 'Journal of the Plague Year.'"[2] This brief sentence sums up the agony of a nation.

Another domain in which the laboratory with its experimental methods is indispensable is the study of the action of drugs, together with the elaboration of new therapeutic substances. Thus adrenalin, which is of such great service in performing bloodless operations, is a drug manufactured in the living body itself, but the synthetic chemist has built it up in the laboratory. Salvarsan was invented as the result of years of investigation, in which both the biologist and the chemist played essential parts. This drug, which has placed in the hands of the therapist a weapon of previously undreamt-of potency in the treatment of one of the gravest and most prevalent infective diseases, syphilis, represented the zenith of the life-work of a man of genius, but it is certain that without the gigantic force of Germany's chemical industry Ehrlich's scientific triumph could not have had its practical accomplishment. The search for drugs which shall exert specific actions in the living body affords a most promising field of investigation, and offers rich results in the amelioration of suffering. Much attention has been devoted to this subject at the Bland-Sutton Institute, and in the flavine compounds, belonging to the group of acridine dyes, substances have been found which possess unique properties as antiseptics, and have been utilised with great advantage by surgeons in their efforts to combat and to prevent the serious consequences of septic infection in war wounds.[3]

Future Work of the Laboratories.

Such enterprise, however, is still in its infancy. There is a great prospect here for the co-operation of chemists and biologists, for it is only by such teamwork that the complexity of modern problems can be resolved. The investigation of many diseases has now reached a stage at which it is futile merely to ask what are the gross marks which they leave behind when they have wrecked health or destroyed life, or what are the agencies which cause these ravages and how we can prevent their attacks. Now we must proceed further and inquire what are the first evidences of the operations of these enemies and by what means can an actual cure be effected. The diseases in which this most important step can be taken are as yet all too few. It must be remembered, however, that prevention is not always possible; therefore, one must still strive after cure. This subject demands serious attention; it is a general belief that sanatoria and the propaganda of education directed towards the prevention of tuberculosis will eradicate this dire disease. But even if tuberculosis may some day become extinct, it is certain that for at least several generations to come cure will continue to be a clamant need, which still we have nothing definite to satisfy.

The Organisation of the Work of the Laboratories.

The information yielded by the laboratory supplies in a great and ever-increasing proportion of cases the indications which are essential for the proper diagnosis of the disease and treatment of the patient, but much of this work has now become routine, and it is most unfortunate that it has frequently been entitled "clinical research." The name is totally misleading, and no policy more inimical to progress could be conceived than that of many hospitals which make arrangements solely for this class of hackwork. It is essential that such investigations should occupy only a portion of the time of the laboratory's staff, and that portion by no means the major one. The chronic and hopeless diseases which occupy so great a part of the medical wards of a hospital, and of which the beginning is obscure, the progress relentless, and the end desperate; epidemic diseases, which yearly cost the City of London alone about half a million pounds; tuberculosis, which probably extorts a greater toll of active adult lives than any other single disease—all these proclaim the necessity for the laboratory workers and the clinicians to co-operate in attacks on disease, not merely from the point of view of the individual patient, but also on a collective basis and with the view of perfecting further methods of prevention and of cure.

It was stated lately in the daily Press that in Australia the blow-fly had caused in one season a loss of sheep to the value of 300,000*l.*, and that, in an endeavour by scientific methods to put an end to this and similar losses, an outlay of 5000*l.* had been decided on. How much more urgently does the whole subject of human disease demand investigation on a scale never hitherto contemplated! In the past this might have been deemed a luxury, in the future it will be recognised as a bare necessity, and of the belligerent countries that which most rapidly builds up its national health will have gone far towards reaping the fruits of victory. By what administrative methods this can be accomplished is a question not discussed here; but one point is clear: that the problems of disease must be solved by the hospitals with the aid of their laboratories, where alone is to be found the stimulus afforded by the problems always present in insistent form. But the problems must be grappled with on a far broader basis than has hitherto been attempted. Medical science is essentially applied science, and the institutes of medical science, if they are to be efficient, must not merely retain the services of all departments of biological science, including biological chemistry, but also include synthetic chemists and physicists. The importance of such a plan has been most fully recognised in America, and has its completest material embodiment in the Rockefeller Institute for Medical Research with the hospital attached thereto, the yearly income of which, derived from endowment, amounted to 600,000*l.* in 1917.

It is specially desirable, too, that the facilities available in the research laboratories of the great manufacturing concerns should be co-ordinated in this scheme. Short of the most thorough comprehensiveness, research in practical medicine is likely to fail to tackle the problems which are of paramount importance.

Prospective Results.

But any scheme of this kind which depends for its continuance on payment by results is foredoomed to failure. This principle has been accepted even for the industrial laboratories; how much more readily ought it, then, to be recognised where the elusive phenomena of life are under investigation, and where the gains take the form of preservation of health and diminution of the burden of human suffering! Health is one of the greatest assets of a people, and this work, which will enhance the value of that asset to an almost incalculable degree, is of the highest national necessity.

[2] Majors H. G. Wells and R. G. Perkins, members of the American Red Cross Commission to Rumania.

[3] It was owing to the action of the Medical Research Committee that the flavine compounds were rendered available.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—The Misses Bunce have made a further very handsome donation of books to the University library, a gift which is of special interest from its association with the late J. Thackray Bunce, who gave valuable services to the University in its earlier stages.

Prof. Percy F. Frankland is resigning the Mason chair of chemistry at the end of the current term. In accepting the resignation with great regret, the Council has expressed to Prof. Frankland its thanks for valuable services rendered to the University during the past twenty-four years, and its hope that the leisure which will follow his resignation will result in his complete restoration to health.

Dr. Parker has resigned his appointment as assistant lecturer and demonstrator in chemistry on being elected research chemist to the Joint Committee of Leeds University and the Institution of Gas Engineers.

IN a letter to Sir John Williams, president of the University College of Wales, Aberystwyth, Major David Davies offers, with his sisters, to contribute the sum of 20,000*l.* to found a chair of international politics at Aberystwyth, in memory of the fallen students of the University of Wales, "for the study of those related problems of law and politics, of ethics and economics, which are raised by the project of a League of Nations, and for the encouragement of a truer understanding of civilisations other than our own." If the proposal is accepted, the donors hope that the chair will be associated with the name of President Wilson.

IN connection with the recent deputation to Mr. Fisher and Mr. Bonar Law to ask for augmented State grants for university purposes, the question of increased remuneration for the non-professorial staff is attracting considerable attention. It is urged that immediate steps should be taken to remedy the present conditions, which should be made widely known. The average annual salary of 330 lecturers in fifteen universities and university colleges of England, Wales, and Ireland is 206*l.* Only 37 per cent. of the lecturers receive a salary above 200*l.* a year, and it is only in the case of these lecturers that the contributory scheme, known as the Federated Superannuation Scheme, is applicable. University teachers are excluded from the operation of the Superannuation Bill for Teachers in Secondary Schools and Technical Colleges, recently passed into law. Conferences of lecturers in universities and university colleges have formulated a scheme for a new salary scale, which has been submitted to the governing bodies and to H.M. Government. At the last conference, which was held at King's College, London, on November 30, it was decided to press for the inclusion of university teachers in a non-contributory pension scheme. It may be pointed out that in the case of the scientific staff, already depleted through the ravages of the war, these matters are of urgent importance in view of the further diminution that may occur through the increased demand for scientific experts in the Government services and in industry.

A REPORT on the work done in London educational institutions during the past three and a half years in the manufacture of munitions and training of munition workers was before the Education Committee of the London County Council on December 12. It appears from a statement by the Education Committee that in June, 1915, the Council agreed to place its resources at the disposal of the Ministry of Munitions and the Metropolitan Munitions Committee. Two lines of action were adopted:—(1) The manufacture of such essential munitions as could be made with the staff and machines available in technical institutions, and (2) the training of workers for munition factories. In connection with the manufacture of munitions the main efforts of the organisation have been directed to the manufacture of precision gauges. About 83,000 gauges have been delivered and passed by the National Physical Laboratory; in addition, sixty-five orders for miscellaneous types of accessories have been completed. With regard to the second item, more than 12,000 students have been in training, of whom about 9000 have completed their courses satisfactorily and been placed in employment. The staff engaged on this work at December 1 last numbered in all 482 persons, 44 of whom belonged to technical institutions, 193 had been transferred from their normal posts in various kinds of schools, and 245 were temporary employees. Machinery and equipment to the amount of about 17,000*l.* have been purchased for manufacture and remain the property of the Council. Certain funds will be available for the reconstitution and equipment of workshops in technical institutions from the manufacturing side. The total value of the work carried out for the manufacture of munitions and the training of munition workers has been of the order of 300,000*l.*

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 21.—Sir J. J. Thomson, president, in the chair.—W. **Stiles** and Dr. F. **Kidd**: The influence of external concentration on the position of the equilibrium attained in the intake of salts by plant-cells. The course of intake of salts by carrot and potato tissue has been followed by measuring the changes in electrical conductivity of the solution of salt presented to the tissue. Concentrations of each salt were employed, ranging from 0·1 to 0·0002 normal. In the case of copper sulphate exosmosis from the tissue exceeds absorption, and this is so with all concentrations of the salt. This is characteristic of toxic substances. Carrot tissue absorbs the chlorides of potassium, sodium, and calcium in all concentrations employed. Absorption takes place at first at a rate approximately proportional to the external concentration, but this relation is not continued with time, as the absorption progresses towards an equilibrium condition in which the ratio of internal to external concentration is not constant, but varies with the concentration. This ratio of internal to external concentration we call the absorption ratio. It decreases with increasing concentration. With low external concentrations, *e.g.* 0·0002*N* and 0·002*N*, it is many times unity; with higher concentrations, *e.g.* 0·1*N*, it is less than unity. The data presented are regarded as inadequate in themselves to justify the conclusion that absorption of salts by the cell is an adsorption process.—W. **Stiles** and Dr. F. **Kidd**: The comparative rate of absorption of various salts by plant tissue. The absorption of various chlorides, sulphates, nitrates, and potassium salts from solutions of 0·02*N* concentration was measured by the electrical conductivity method employed in the investigation recorded in the previous paper. Kations appear to be absorbed initially in the following order:—K[Ca,Na]Li[Mg,Zn]Al. The position of ions enclosed within brackets may have to be reversed. This initial order does not indicate, however, the extent to which the ions are absorbed when equilibrium is reached; the order is then K,Na,Li[Ca,Mg]. The chief difference between this order and the initial order is in the position of Ca,

which is ultimately absorbed to only a slight extent compared with K and Na. Anions are absorbed initially in the order SO_4,NO_3,Cl, which gives place later to the order NO_3,Cl,SO_4 on account of the comparatively slight extent to which the sulphate ion is absorbed. The difference between nitrate and chloride is slight, and no stress can be laid on it. These results agree in general with those of Ruhland, Fitting, Pantanelli, and Troendle using different methods and different experimental material. These authors did not, however, distinguish between initial rates of absorption and the position of final equilibrium. The position of final equilibrium appears to be governed by some quite different property from that which determines the initial rate of intake.—G. **Marinesco**: Recherches anatomo-cliniques sur les névromes d'amputations douloureux. Nouvelles contributions à l'étude de la régénération nerveuse et du neurotropisme.

Physical Society, November 8.—Prof. C. H. Lees, president, in the chair.—Prof. J. C. **McLennan**: Low-voltage arcs in metallic vapours. The paper describes experiments by Messrs. Hamer and Kemp, students of the author's, at Toronto University. The experiments show that increasing the temperature of the incandescent cathode lowers the voltage necessary to produce arcs in the vapours of mercury, zinc, and cadmium. With limed platinum cathodes arcing voltages were not obtained so low as with incandescent tungsten filaments. With mercury it was found possible to strike arcs with voltages as low as 4·75 volts, and to maintain them at 2·84 volts. Corresponding figures for cadmium were 5 and 2 volts. To obtain these very low arcing voltages it was necessary to use intensely hot cathodes and a copious supply of highly heated metallic vapour. With moderately heated incandescent cathodes and a moderate supply of metallic vapour the arcing voltages were given by the quantum relation $V=h\times(1{\cdot}5,S)/e$, where 1·5,S is the frequency of the shortest wavelength in the $\nu=1{\cdot}5,S-mP$ series.—Dr. W. **Wilson**: Relativity and gravitation. The motion of a particle in a gravitational field is treated from the point of view of the general theory of relativity. It is shown that the equations of motion of the particle can be expressed in the following Hamiltonian form:—

$$\frac{dp_s}{d\tau}=-\frac{\partial H}{\partial x_s},$$
$$\frac{dx_s}{d\tau}=\frac{\partial H}{\partial p_s},$$

where p_s is the s component of the covariant 4-vector momentum, x_s the corresponding positional co-ordinate, and τ the Minkowskian "Eigenzeit." A short outline of the Minkowskian theory of relativity is included in the paper.—C. R. **Gibson**: Experiments on colour-blindness. The apparatus shown consisted of a lantern to produce a bright beam of white light and a coloured glass which could be slipped in front of it, so as to cut out all the red rays. Various samples of coloured cloths and ribbons arranged in pairs, while quite dissimilar when viewed by the white light, appeared perfect matches with the screen interposed, the conditions then being similar to those in the case of a red-blind person. The author had found in experimenting with wools by this method that many coloured wools were unsuitable for the purpose on account of fluorescence. Thus although no red light fell on them from the apparatus, there was plenty of red in the light reflected by the wools. In these cases, in order to see what the colours would appear to the red-blind man, it was necessary to have the filter between the wool and the eye, and not simply between the source of light and the wool.

Royal Anthropological Institute, November 26.—Prof. A. Keith, past president, in the chair.—Prof. F. G. **Parsons**: Some points in the anthropology of German prisoners of war. Owing to the refusal of the German military authorities to allow the Army to be used for anthropometric purposes, the anthropology of Germany was probably less well worked out than that of any other European country. The author's present contribution consisted of observations on 925 German prisoners in the war hospitals at Sutton and Dartford, and included the cephalic index, the facial index, the index of nigrescence, and the stature, though his generalisations on the last point were still incomplete, as there existed a large mass of statistics in the hands of the Government to be worked up. With regard to the cephalic index, he found that the German average was 82·5, against the 78·2 of 227 British soldiers and medical students, and that the German head was not only actually shorter, but also actually broader than the British. A map of the distribution of the head-form in Germany showed that the longest heads were found in the north-west (Schleswig, Hanover, Westphalia, and Rhineland), while the shortest were in the south-east (Bavaria and Silesia). The lowest cephalic index was that of Oldenburg (802), and the highest Bavaria (845). The facial index showed no approach to the long Nordic face of England and Scandinavia anywhere in Germany, while a map of the index of nigrescence showed that the colouring of the people had a general agreement with the head shape, the lighter pigmentation accompanying the longer heads, and *vice versa*.

PARIS.

Academy of Sciences, November 18.—M. P. Painlevé in the chair.—M. J. A. Battandier was elected a correspondant for the section of botany in succession to the late M. Grand'Eury.—J. **Droch**: The complex groups of rationality and the integration by quadrature.—T. **Lalesco**: Periodic polygonal functions.—R. **Garnier**: Elementary solution of the problem of the inversion of elliptic functions.—R. **Goormaghtigh**: Generalisation of Jamet's theorems on the curvature of triangular curves, and of symmetrical tetrahedral curves and surfaces.—E. **Belot**: The laws of internal density in theories of the sun.—E. **Hildt**: The estimation of lactose. The use of benzene or phenol-sulphonic acid is recommended for the hydrolysis.—J. **Lambert**: The presence of a fasciole in a Procassidulid.—P. **Bertrand**: Distinctive characters of the flora of the Coal Measures of Saint-Etienne and Rive-de-Gier.—A. **Piédallu**: A new arrangement for the use of explosives applied to tree planting. Its advantageous utilisation in the rapid reconstitution of orchards devastated by the enemy. The use of a special cartridge is suggested for making holes suitable for tree planting.—A. **Grigaut** and Fr. **Moutier**: An attempt at the treatment of influenza by plasmotherapy (intravenous injections of plasma from a convalescent). The treatment is effective only if the injection is made before the third day of the attack.—C. **Richet**: Comments on the preceding paper.

November 25.—M. P. Painlevé in the chair.—Gen. **Bourgeois**: A method of determining the direction and velocity of the wind in cloudy weather. Small balloons are let up, arranged so as to explode small charges of melenite at regular intervals; sound telemeters record the explosions, and the position in space of the points of detonation can be thus determined.—M. Maurice Leblanc was elected a member of the division of science applied to industry, and M. Sauvageau a correspondant for the section of botany in succession to the late Charles Eugène Bertrand.—M. **Petrovitch**: The spectral determination of func-

tions.—P. **Humbert**: The Poincaré surfaces of order 6. —J. de **Schokalsky**: The hydrographical exploration of the coasts of Siberia in 1918 by the Russian Marine Ministry.—J. **Mueller**: The solubility of copper hydroxide in presence of sodium and potassium hydroxides. Concentrated solutions of caustic potash and soda keep in solution appreciable quantities of copper hydroxide. On diluting and boiling, in some cases all the copper is still held in solution; in others some of the copper is precipitated. No organic substance or other metallic oxide was present in these experiments.—T. **Komninos**: A new synthesis of aromatic from fatty compounds. Acetone and malonyl chloride react in presence of marble, and from the products of the reaction the substance

$$CH_3—CO—CH_2—CO—CH_2—COCl$$

was isolated. This loses another molecule of hydrogen chloride under the action of marble, giving phloroglucinol. This synthesis can probably be generalised. —J. de **Lapparent**: The felspar crystals developed in limestones of the Upper Pyrenees Cretacean.—M. **Molliard**: The production of glycocoll by *Isaria densa*. The growth of this fungus on gelatine gives a yield of 33 per cent. of this amino-acid, whilst the acid hydrolysis of gelatine gives only half this amount. Fibrin, hydrolysed by acids, gives only 3 per cent. of aminoacetic acid, whilst the fungus gives a 38 per cent. yield.—J. **Amar**: The mental function in feminine work.—P. **Godin**: Practical application of the "Fiche scolaire" (mental and physical record) to a pupil followed from 11 to 12½ years of age.—J. **Nageotte** and L. **Sencert**: Functional grafts of dead arteries.

BOOKS RECEIVED.

Archæological Survey of India. New Imperial Series. Vol. xl. The Astronomical Observatories of Jai Singh. By G. R. Kaye. Pp. viii+151+xxvi plates. (Calcutta.) 23*s*.

Submarine and Anti-Submarine. By Sir H. Newbolt. Pp. viii+312. (London: Longmans and Co.) 7*s*. 6*d*. net.

Cotton. By G. Bigwood. Pp. viii+204. ("Staple Trades and Industries.") (London: Constable and Co., Ltd.) 6*s*. 6*d*. net.

The Psychology of Conviction: A Study of Beliefs and Attitudes. By Prof. J. Jastrow. Pp. xix+387. (Boston and New York: Houghton Mifflin Co.; London: Constable and Co., Ltd.) 10*s*. 6*d*. net.

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 12.

ROYAL SOCIETY, at 4.30.—Leonard Hill and Hargood Ash: The Cooling and Evaporative Powers of the Atmosphere, as Determined by the Katathermometer.—H. C. Bazett: Observations on Changes in the Blood Pressure and Blood Volume following Operations in Man.—Dr. M. C. Stopes: The Four Visible Ingredients in Banded Bituminous Coal.

OPTICAL SOCIETY, at 8.—Instructor-Commander T. Y. Baker and Major L. N. G. Filon: An Empirical Formula for the Longitudinal Spherical Aberrations in a Thick Lens.—Major E. O. Henrici: Spirit Levels.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Discussion on Electric Welding.

MATHEMATICAL SOCIETY, at 5.—G. H. Hardy and J. E. Littlewood: Applications of the Method of Farey Dissection in the Analytic Theory of Numbers: (1) A New Solution of Waring's Problem; (2) Proof that every Large Number is the Sum of at most 33 Biquadrates; (3) The Riemann Hypothesis and the Expression of a Number as the Sum of a Stated Number of Primes.—N. M. Shah and B. M. Wilson: Numerical Data connected with Goldbach's Theorem.

FRIDAY, DECEMBER 13.

ROYAL ASTRONOMICAL SOCIETY, at 5.—J. Lunt: The Dark Line Spectrum of Nova Geminorum No. 2.—A. King: A Shower of Shooting Stars from the Pleiades.—J. H. Jeans: The Evolution of Binary Systems. —C. P. Butler: The Presence of G and K Type Bands in the Early Spectra of Nova Aquilæ III (1918).—*Probable Paper*: A. A. Rambaut: Observations of the Magnitude of Nova Aquilæ, 1918, made at Radcliffe Observatory, Oxford, and a Comparison with the Radcliffe Magnitudes of Nova Persei, 1901.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.

MONDAY, DECEMBER 16.

ROYAL GEOGRAPHICAL SOCIETY, at 5.

ROYAL SOCIETY OF ARTS, at 5.—Prof. J. C. Philip: Physical Chemistry and its Bearing on the Chemical and Allied Industries.

ARISTOTELIAN SOCIETY, at 8.—Prof. John Laird: Synthesis and Discovery.

TUESDAY, DECEMBER 17.

INSTITUTION OF CIVIL ENGINEERS, at 5.30.—*Papers to be Discussed*: E. L. Leeming: Road-corrugation.—F. Wood: Investigations in the Structure of Road-surfaces.—T. B. Bower: Notes on Road Construction and Maintenance.

INSTITUTION OF PETROLEUM TECHNOLOGISTS, at 5.30.—Dr. F. Mollwo Perkin: The Production of Oil from Mineral Sources.

ROYAL STATISTICAL SOCIETY, at 5.15.—Dr. John Brownlee: Notes on the Biology of a Life Table.

WEDNESDAY, DECEMBER 18.

GEOLOGICAL SOCIETY, at 5.30.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Col. A. Castellani: Tropical Diseases met with in the Balkanic War Zone.

ROYAL METEOROLOGICAL SOCIETY, at 5.—Capt. C. J. P. Cave, R.E.: A Cloud Phenomenon.—C. E. P. Brooks: Notes on a Meteorological Journal at Wei-Hai-Wei, kept by Commander A. E. House, R.N., 1910–1916.—Capt. E. H. Chapman: The Annual Symmetrical Variation of Certain Elements and a Note on the Choice of Seasons.

THURSDAY, DECEMBER 19.

CHEMICAL SOCIETY, at 8.—Prof. F. Soddy: The Conception of the Chemical Element as Enlarged by the Study of Radio-active Change.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—P. Hunter-Brown: Carbon Brushes, Considered in Relation to the Design and Operation of Electrical Machinery.

ILLUMINATING ENGINEERING SOCIETY, at 8.—*Discussion opened by the President*: Summary of Progress in Photometry, with Special Reference to War Problems.

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